



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Eighth Progress Report, being the Fourth
Annual Report of the Sugarcane
Research Station, Mauritius.
for the Year 1933.

Printed for the Board of the College of Agriculture, Mauritius.

For circulation to its Members.

SUGARCANE RESEARCH STATION, MAURITIUS.

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Fourth Annual Report of the Sugarcane Research Station, Mauritius, for the Year 1933.

INTRODUCTION.

The Senior Geneticist was absent on leave from 21st January until the 22nd December, during which time the Station was in charge of the Physiological Botanist for the period 21st January to 22nd March, and under the Bio-Chemist for the period 23rd March to 22nd December.

In general, the work of the Station has followed the lines described in previous annual reports, no changes being made in our programmes for plant breeding, bio-chemistry and physiological botany. No attempt has yet been made to introduce cultivation experiments into our programme, as the standard of field work on the estates in the island is high, so that it is thought that research is best confined to those subjects which planters cannot easily carry out for themselves.

By the abolition of the Empire Marketing Board in September, 1933, the annual grant of Rs. 22,204, normally due to terminate in December, 1934, came to an end. The Board's commitments until that date, however, are being met by a grant from Imperial funds.

PART I.

CANE BREEDING.

GENERAL.

The organisation for the crossing season was as follows: the Physiological Botanist took charge of all crossing work at the Central Experiment Station, Réduit, the Scientific Assistant to the Senior Geneticist being in charge of the breeding work on the near-by estates, notably Ebène, Béga and Trianon. The Cane Breeding Officer carried out the crossing programme at Pamplemousses Experiment Station and the adjoining estates as in the past.

The crossing season, although far from normal as regards weather conditions, was a successful one, ample seedlings being raised for all our needs.

The chief object of the cane-breeding programme is to pursue the most modern methods of producing new seedling varieties, including the successful Java method, and to test all newly-produced or imported varieties in critically designed yield trials. An attempt is made here to condense and tabulate as far as possible an account of the work carried out in 1933.

In Table I below is shown the range of the breeding work in 1933 as compared with the three previous years. It will be noticed that the number of first-year seedlings planted out in the field was considerably reduced. This was made possible largely as a result of accumulated knowledge regarding the merits of the various combinations of parents, and also as a result of discarding a proportion of the seedlings in the pot stage. Such a reduction in numbers is highly desirable now in view of the time that must be given to the study of the second and third-year selections made since 1930, when the breeding programme was begun.

TABLE I.

A SUMMARY OF CANE BREEDING WORK, 1930—1933.

NUMBER OF:	1930	1931	1932	1933
(1) Controlled crosses made, including self-ings	409	355	457	446
(2) Uncontrolled crosses	569	370	46	1
(3) 1st year seedlings raised in boxes	52,840	72,888	157,948	64,883
(4) 1st year seedlings potted out for planting	20,108	29,263	35,863	26,032
(5) 1st year seedlings planted out on experiment stations from (4) above	18,888	22,011	23,016	18,993
(6) 1st year seedlings distributed to estates for potting and planting out	3,000	5,000	16,040	3,645
(7) Mature seedlings from (5) and (6) above, selected to date for testing in 2nd-year seedling trials	233	263	130	—
(8) 2nd year seedlings from (7) above, selected to date for testing in 3rd-year seedling trials	32	—	—	—

TYPES OF CROSSES MADE.

As there are already a considerable number of 1st Nobilised Glagah types in the breeding plots few crosses were made with Glagah during the year.

A considerable number of crosses were made, using those varieties that have proved to be good parents in the past. The variety M.23/16 would appear to be particularly good in this respect when used as a female.

Many of the old varieties recently collected into a "museum" at Réduit, flowered in 1933 for the first time, and these were crossed for the most part with disease-resisting types, disease usually having proved to be the downfall of these old varieties which otherwise were often admirable canes. Several varieties brought back from Java by the writer in 1930 also flowered for the first time and were used in crossing. The variety BH.10(12), normally a non-arrowing variety locally, was found arrowing at Australia and California Sugar Estates and was used by the Cane Breeding Officer at Pamplémousses.

In last year's annual report a cross between *Saccharum Officinarum* and *Saccharum Munja* (Roxb.) was reported. The majority of the seedlings of this cross now exhibit many of the wild characteristics of the male parent and few of the female parent. Judged by appearances this 1st Nobilised *Saccharum Munja* will not prove to be such a good-breeding type as 1st Nobilised Glagah, although it may prove useful in the production of high polyploid forms.

As far as the writer is aware this is the first time that 1st Nobilised *Saccharum Munja* has been produced in cane breeding.

A further attempt was made to cross *Sorghum* with noble canes and, judging by the appearance of certain seedlings, it would appear that the cross has been made by the Cane Breeding Officer at Pamplémousses.

TABLE II.

TYPES OF CROSSES MADE, 1933.

		Réduit and District	Pamplémousses and District	Total
INTERSPECIFIC :				
1st Nobilised Crosses	...	5	—	5
2nd " "	...	6	1	7
3rd " "	...	12	16	28
4th " "	...	75	41	116
5th " "	...	2	1	3
Noble cane x Chunnee types		20	—	20
" x Sinense types		30	9	39
INTERGENERIC :				
Noble cane x Sorghum	...	3	5	8
NOBLE CROSSES	...	139	53	192
OTHER COMBINATIONS	...	9	9	18
Total	...	301	135	436*

CROSSING TECHNIQUE.

The methods used for crossing were little changed from previous years, excepting that very few crosses were carried out by the Cage method, while the Wind-Shield method was not used as little trouble was experienced from high winds. The Open and Bag methods were the most successful, the Lantern method failing to give the successful results obtained in 1932.

At Pamplémousses the Cane Breeding Officer carried out thirty crosses simultaneously, ten by each method, (i.e. Open, Bag and Lantern) the number of seedlings produced by each method being 747, 616 and 484 seedlings per cross respectively.

TABLE III.

A COMPARISON OF THE CROSSING METHODS USED IN 1933.

CROSSING METHOD		Number of seedlings obtained at :			
		Réduit		Pamplémousses	
		Per cross	Total	Per cross	Total
Calico cage	...	55	165	—	—
Glass lantern	...	18	452	253	9,376
Calico bag	...	115	1,474	250	11,246
Open (unprotected)	...	112	26,874	355	15,281

FIRST-YEAR SEEDLINGS.

Approximately 19,000 first-year seedlings were planted out in the field at Réduit and Pamplémousses experiment stations. The parentage of these seedlings is given in Table V at the end of this report. The raising of seedlings at Réduit is now considerably more economical than in the past owing to the recent provision of irrigation water from Le Réduit Canal.

* Excludes 10 selfings included in total of Table No. I.

SECOND-YEAR SEEDLINGS.

Three hundred and sixty-six first-year seedlings were selected during the year for putting into second-year seedling trials, 236 of these having been bred in 1931 and 130 in 1932. These second-year seedlings, excepting the first and second nobilised Glagah types, were planted in small-scale yield trials laid out in the form of latin squares $10' \times 10'$, each square containing nine new seedlings plus a standard variety. With a view to improving on the normal layout of this form of small-scale trial, experiments have been laid down at Réduit by the Bio-Chemist and Physiological Botanist to test the possibilities of the randomised block plan and a modified latin square layout using wider spacing, $5' \times 5'$ instead of $5' \times 2\frac{1}{2}'$.

THIRD-YEAR SEEDLINGS.

Thirty-two second-year seedlings from amongst 189 seedlings in 21 latin squares were selected for testing in third-year trials, laid down either as randomised blocks or according to the Faulkner layout. A list of these with their parentage is given in Table IV below. Approximately 80 to 150 holes of each variety were planted in rows of 20 to 30 holes long, allowing 4 or more replicates of each variety.

With a view to determining the optimum layout for yield trials with sugarcane the Physiological Botanist undertook a comprehensive investigation into this problem the results of which are analysed on page 51 of this report. The results of this original investigation should be of considerable aid to us in the testing of new-cane varieties.

Considerably improved germination was obtained in 1933 in all yield trials through soaking setts before planting in a saturated solution of lime as recommended by the Physiological Botanist following an investigation on this subject. (See page 36).

TABLE IV.

THIRD-YEAR SEEDLING TRIALS LAID DOWN IN 1933.

" M " No.	Parentage	Trial No.	" M " No.	Parentage	Trial No.
M. 5/30	R.P.6 x 131.P	43	M. 71/30	Ba. 11569 x 131.P	55
M. 8/30	R.P.6 x 131.P	43	M.106/30	POJ. 2878	
M. 10/30	R.P.6 x 131.P	43		x Uba Marot...	55
M. 11/30	R.P.6 (G.C.)	43	M.108/30	POJ. 2878	
M. 13/30	R.P.6 (G.C.)	43		x Uba Marot...	55
M. 18/30	Ba. 11569		M.113/30	R.P.6 x M.23/16	56
	x Senneville...	43	M.117/30	Ba. 11569 x DK.74	56
M. 27/30	Ba. 11569 x M.27/16	41	M.129/30	R.P.6 (G.C.)	56
*M.28/30	Ba. 11569 x M.27/16	41	M.161/30	Ba. 11569 x D. 109	56
M. 41/30	R.P.6 x M.35/17	41	M.163/30	M.20/16 x M.35/17	56
M. 46/30	R.P.6 x Senneville	41	M.171/30	R.P.6 x M.27/16	58
M. 48/30	R.P.6 x Senneville	41	M.186/30	R.P.6 x 131.P	58
M. 50/30	R.P.6 x Senneville	41	M.195/30	M.20/16 x D.109	58
M. 54/30	R.P.6 x 87.P	42	M.197/30	M.20/16 x D.109	58
M. 57/30	M.26/20 x M.23/16	42	M.199/30	M.20/16 x M.27/16	58
M. 59/30	131.P (G.C.)	42	M.118/30	Ba. 11569 x DK.74	Two rows only
M. 78/30	R.P.6 x 131.P	42			at P.E.S.
†M.88/30	DK.74 x D.109	42			
M. 96/30	Uba Marot (selfed)	42			Total ... 32
M. 28/30	Ba. 11569 x M.27/16	55			

* Also selected independently at Réduit C.E.S. See Trial No. 55.

† Male parentage doubtful.

BEST PARENTS.

The best parents as judged by the parentage of the seedlings selected in 1933 for third-year trials were as follows: *Female Parents*.—R.P.6 (fifteen seedlings), Ba. 11569 (seven), M.20/16 (four), POJ. 2878 (two). *Male Parents*.—131.P (six), Senneville (four), M.27/16 (four), D.109 (four), M.35/17 (two), M.23/16 (two), and Uba Marot (two).

VARIETY YIELD TRIALS.

The results from eighteen trials cut in 1933 are given below. These figures should be compared with the published results from the same experiments in previous years. The conclusions drawn are in respect of yields of sucrose per acre and not tonnage of cane. None of the new varieties bred by the station since 1930 are as yet included in these trials. These trials, conducted for the most part on estates, are the results of co-operation between the Sugarcane Research Station and the Planters who have always extended every help and courtesy.

TRIAL NO. 1, ST. AUBIN S.E. (2ND RATOONS).

	SUCROSE	CANE
Average yield of 67 standard plots of White Tanna	5.46 t.p.a.	= (37.3 t.p.a.)
Average difference of 11 plots of:		
BH.10(12)	+ 0.14 t.p.a.	= (32.4 t.p.a.)
R.P.6	+ 0.43 t.p.a.	= (38.4 t.p.a.)
R.P.8	- 0.17 t.p.a.	= (33.8 t.p.a.)
M.23/16	+ 0.06 t.p.a.	= (34.1 t.p.a.)
M.27/16	- 1.12 t.p.a.	= (31.3 t.p.a.)
M.12/21	- 3.36 t.p.a.	= (20.6 t.p.a.)
Standard error of difference of experimental plots	± 0.32	
Date of cutting, 28th October, 1933.		

Conclusions: There was no significant difference between White Tanna, the standard, and the four varieties BH.10(12), R.P.6, R.P.8, and M.23/16, but the standard was significantly better than the two varieties M.27/16 and M.12/21. Owing to the extremely low yields from the plots of M.12/21 the adjacent standard lines of White Tanna were greatly benefitted, so that the yield from those lines adjacent to M.12/21 were generally higher than from the White Tanna lines adjacent to other varieties.

TRIAL NO. 2, ST. AUBIN S.E. (2ND RATOONS).

	SUCROSE	CANE
Average yield of 31 standard plots of White Tanna	5.03 t.p.a.	= (35.5 t.p.a.)
Average difference of 5 plots of:		
M.27/16	+ 0.29 t.p.a.	= (35.1 t.p.a.)
M.13/18	+ 0.83 t.p.a.	= (42.0 t.p.a.)
M.17/18	- 2.46 t.p.a.	= (21.0 t.p.a.)
M.33/19	- 2.36 t.p.a.	= (22.7 t.p.a.)
M.15/20	- 0.99 t.p.a.	= (29.4 t.p.a.)
M.26/20	+ 0.90 t.p.a.	= (38.3 t.p.a.)
Standard error of difference of experimental plots	± 0.31	
Date of cutting, 25th October, 1933.		

Conclusions: M.26/20 and M.13/18 were significantly better than White Tanna, while the varieties M.17/18, M.33/19, and M.15/20 were significantly worse. M.27/16 gave a slightly higher yield than White Tanna, the increase not being significant.

TRIAL No. 3, ST. AUBIN S.E. (2ND RATOONS.)

				SUCROSE	CANE
Average yield of 31 standard plots of White Tanna				6.26 t.p.a.	= (45.3 t.p.a.)
Average difference of 5 plots of:					
M. 12/21	...	...	...	- 2.35 t.p.a.	= (35.2 t.p.a.)
M. 5/22	...	...	...	- 2.02 t.p.a.	= (33.9 t.p.a.)
M. 7/23	...	...	...	+ 0.76 t.p.a.	= (44.9 t.p.a.)
M. 10/25	...	...	...	+ 1.14 t.p.a.	= (49.3 t.p.a.)
M. 14/26	...	...	...	- 0.95 t.p.a.	= (39.7 t.p.a.)
M.109/26	...	...	...	- 0.22 t.p.a.	= (45.3 t.p.a.)
Standard error of difference of experimental plots	...	...	...	...	± 0.61
Date of cutting, 31st October, 1933.					

Conclusions: M.10/25 and M.7/23 gave higher yields than White Tanna but not enough to be significant. M.109/26 and M. 14/26 also showed no significant difference from the standard. M.12/21 and M.5/22 were significantly worse.

TRIAL No. 4, UNION (DUCRAY) S.E. (2ND RATOONS.)

				SUCROSE	CANE
Average yield of 26 standard plots of White Tanna				3.39 t.p.a.	= (21.0 t.p.a.)
Average difference of 5 plots of:					
M. 1/17	...	...	...	+ 2.49 t.p.a.	= (41.2 t.p.a.)
M. 5/22	...	...	...	+ 3.95 t.p.a.	= (44.3 t.p.a.)
M. 7/23	...	...	...	+ 4.34 t.p.a.	= (49.1 t.p.a.)
M.10/25	...	...	...	+ 2.65 t.p.a.	= (39.5 t.p.a.)
M.12/21	...	...	...	+ 3.71 t.p.a.	= (50.2 t.p.a.)
Standard error of difference of experimental plots	...	...	...	...	± 0.23
Date of cutting, 18th October, 1933.					

Conclusions: All the experimental varieties were better than White Tanna, the standard. M.5/22 and M.12/21 are not recommended for further propagation however, as the former is very susceptible to Gummosis, while the latter has poor juices and has other undesirable traits.

TRIAL No. 5, UNION (DUCRAY) S.E. (2ND RATOONS.)

				SUCROSE	CANE
Average yield of 26 standard plots of White Tanna				3.27 t.p.a.	= (19.9 t.p.a.)
Average difference of 5 plots of:					
M.27/16	...	...	...	+ 4.43 t.p.a.	= (48.7 t.p.a.)
M.29/16	...	...	...	+ 3.49 t.p.a.	= (42.2 t.p.a.)
M.34/22	...	...	...	+ 2.60 t.p.a.	= (41.0 t.p.a.)
M.57/26	...	...	...	- 0.33 t.p.a.	= (20.4 t.p.a.)
BH.10(12)	...	...	...	+ 3.57 t.p.a.	= (36.5 t.p.a.)
Standard error of difference of experimental plots	...	...	...	...	± 0.35
Date of cutting, 19th October, 1933.					

Conclusions: All the experimental varieties, excepting M.57/26, were better than White Tanna, the standard. The best in order of merit being M.27/16, BH.10(12) and M.29/16. The last-named is a very brittle cane liable to suffer much damage in cyclones.

TRIAL No. 6, MON ROCHER S.E. (2ND RATOONS).

	SUCROSE	CANE
Average yield of 5 standard plots of White Tanna	2.86 t.p.a. =	(21.0 t.p.a.)
Average difference of 4 plots of POJ.2878	+ 3.15 t.p.a. =	(38.3 t.p.a.)
Standard error of difference of experimental plots	...	± 0.52

Date of cutting, 27th September, 1933.

Conclusions: POJ.2878 was significantly better than White Tanna, confirming the results obtained in virgins and first ratoons.

TRIAL No. 7, MON ROCHER S.E. (2ND RATOONS).

	SUCROSE	CANE
Average yield of 31 standard plots of D.109	5.76 t.p.a. =	(39.1 t.p.a.)
Average difference of 5 plots of:		
M.27/16	+ 0.56 t.p.a. =	(38.6 t.p.a.)
M.13/18	+ 0.34 t.p.a. =	(42.9 t.p.a.)
M.17/18	- 2.92 t.p.a. =	(27.3 t.p.a.)
M.33/19	- 2.56 t.p.a. =	(27.9 t.p.a.)
M.15/20	- 0.50 t.p.a. =	(32.5 t.p.a.)
M.26/20	- 0.16 t.p.a. =	(33.1 t.p.a.)

Standard error of difference of experimental plots ... ± 0.35

Date of cutting, 15th November, 1933.

Conclusions: There was no significant difference between the Standard D.109 and the varieties M.26/20, M.15/20, M.13/18, and M.27/16. M.33/19 and M.17/18, however, were significantly worse than D.109.

TRIAL No. 8, MON ROCHER S.E. (2ND RATOONS).

	SUCROSE	CANE
Average yield of 31 standard plots of BH.10(12)	5.48 t.p.a. =	(31.0 t.p.a.)
Average difference of 5 plots of:		
M. 12/21	- 1.50 t.p.a. =	(31.2 t.p.a.)
M. 5/22	+ 0.10 t.p.a. =	(35.6 t.p.a.)
M. 7/23	+ 0.02 t.p.a. =	(33.5 t.p.a.)
M. 10/25	- 1.96 t.p.a. =	(26.0 t.p.a.)
M. 14/26	- 0.60 t.p.a. =	(32.3 t.p.a.)
M.109/26	+ 1.14 t.p.a. =	(39.1 t.p.a.)

Standard error of difference of experimental plots ... ± 0.48

Date of cutting, 18th November, 1933.

Conclusions: M.109/26 was significantly better than BH.10(12), the standard, while M.12/21 and M.10/25 were significantly worse. There was no significant difference between BH.10(12) and the following: M.5/22, M.7/23, and M.14/26.

TRIAL No. 10, BEAU CHAMP S.E. (1ST RATOONS).

	SUCROSE	CANE
Average yield of 31 standard plots of White Tanna	2.45 t.p.a. =	(17.7 t.p.a.)
Average difference of 5 plots of:		
BH.10(12)	+ 3.37 t.p.a. =	(35.5 t.p.a.)
M.27/16	+ 4.46 t.p.a. =	(50.4 t.p.a.)
M.13/18	+ 2.82 t.p.a. =	(39.1 t.p.a.)
M. 5/22	+ 1.55 t.p.a. =	(31.4 t.p.a.)
M.15/16	+ 2.70 t.p.a. =	(37.4 t.p.a.)
M.29/16	+ 4.83 t.p.a. =	(50.2 t.p.a.)

Standard error of difference of experimental plots ... ± 0.25

Date of cutting, 10th October, 1933.

Conclusions: All the experimental varieties were better than White Tanna, M.27/16 and M.29/16 being significantly better than all the others, although not significantly different from one another.

TRIAL NO. 11, BEAU CHAMP S.E. (1ST RATOONS).

			SUCROSE	CANE
Average yield of 31 standard plots of White Tanna			2.80 t.p.a. =	(19.8 t.p.a.)
Average difference of 5 plots of:				
M. 35/17	...	...	+ 1.23 t.p.a. =	(26.4 t.p.a.)
M. 23/16	...	...	+ 4.19 t.p.a. =	(43.9 t.p.a.)
M. 12/21	...	...	+ 0.00 t.p.a. =	(23.3 t.p.a.)
M. 19/17	...	...	+ 0.38 t.p.a. =	(25.4 t.p.a.)
M.108/26	...	...	- 0.26 t.p.a. =	(20.4 t.p.a.)
M. 9/18	...	...	+ 1.33 t.p.a. =	(27.7 t.p.a.)
Standard error of difference of experimental plots ± 0.35				
Date of cutting, 11th October, 1933.				

Conclusions: M.23/16 was significantly better than all the other varieties. M.35/17 and M.9/18 were not significantly different from one another, but both were significantly better than White Tanna. There was no significant difference between White Tanna and the varieties M.12/21, M.19/17, and M.108/26.

TRIAL NO. 12, BELLE RIVE, BEAU CHAMP S.E. (VIRGINS).

			SUCROSE	CANE
Average yield of 31 standard plots of White Tanna			6.88 t.p.a. =	(51.2 t.p.a.)
Average difference of 6 plots of:				
BH.10(12)	...	...	- 2.71 t.p.a. =	(36.8 t.p.a.)
M.23/16	...	...	- 0.16 t.p.a. =	(60.3 t.p.a.)
M.27/16	...	...	- 0.76 t.p.a. =	(51.3 t.p.a.)
M.13/18	...	...	- 1.20 t.p.a. =	(47.2 t.p.a.)
M.12/21	...	...	- 4.86 t.p.a. =	(24.8 t.p.a.)
Standard error of difference of experimental plots ± 0.44				
Date of planting, November, 1931. Date of cutting, 20th September, 1933.				

Conclusions: The standard variety White Tanna gave the highest yield, but there was no significant difference between it and M.23/16 and M.27/16, the next varieties in order of yield. White Tanna was significantly better than BH.10(12), M.13/18 and M.12/21.

TRIAL NO. 13, BELLE RIVE, BEAU CHAMP S.E. (VIRGINS).

			SUCROSE	CANE
Average yield of 31 standard plots of White Tanna			6.95 t.p.a. =	(50.1 t.p.a.)
Average difference of 6 plots of:				
M. 5/22	...	...	- 5.13 t.p.a. =	(18.0 t.p.a.)
M. 7/23	...	...	- 2.73 t.p.a. =	(31.4 t.p.a.)
M. 10/25	...	...	- 3.43 t.p.a. =	(27.3 t.p.a.)
M. 14/26	...	...	- 4.61 t.p.a. =	(22.1 t.p.a.)
M.109/26	...	...	- 5.22 t.p.a. =	(18.4 t.p.a.)
Standard error of difference of experimental plots ± 0.43				
Date of planting, November, 1931. Date of cutting, 23rd September, 1933.				

Conclusions: White Tanna was significantly better than all the seedling varieties in the experiment. (*Note:* The canes in the two trials above (Nos. 12 and 13) were growing for a period of approximately 22 months, so that all the seedling varieties due to their early maturity had become over-ripe with the results that many canes had lodged and dried out. Many seedling varieties under trial at present would appear not to be suitable for a long virgin crop, whereas White Tanna appears unsuitable for a short virgin crop).

TRIAL NO. 14, MON DESERT (MOKA) S.E. (VIRGINS).

				SUCROSE	CANE
Average yield of 22 standard plots of White Tanna				6.38 t.p.a.	= (11.0 t.p.a.)
Average difference of 4 plots of:					
M. 27/16	...	...	...	- 0.16 t.p.a.	= (45.1 t.p.a.)
M. 12/21	...	...	...	- 3.58 t.p.a.	= (30.6 t.p.a.)
M. 10/25	...	...	...	- 2.86 t.p.a.	= (27.8 t.p.a.)
M. 14/26	...	...	...	- 0.19 t.p.a.	= (44.8 t.p.a.)
M.109/26	...	...	...	- 2.46 t.p.a.	= (25.0 t.p.a.)
Standard error of difference of experimental plots	...	...	...	± 0.23	

Date of planting, December, 1931. Date of cutting, September, 1933.

Conclusions: White Tanna, M.27/16, and M.14/26 gave the highest yields, but there was no significant difference observed between these three, whilst all three were significantly better than M.12/21, M.10/25, and M.109/26.

TRIAL NO. 15, BRITANNIA S.E. (VIRGINS).

				SUCROSE	CANE
Average yield of 18 standard plots of White Tanna				7.26 t.p.a.	= (50.4 t.p.a.)
Average difference of 5 plots of:					
M. 23/16	...	...	...	+ 0.50 t.p.a.	= (57.6 t.p.a.)
M. 27/16	...	...	...	- 2.11 t.p.a.	= (40.1 t.p.a.)
M. 13/18	...	...	...	- 1.87 t.p.a.	= (43.1 t.p.a.)
M. 26/20	...	...	...	- 2.62 t.p.a.	= (32.1 t.p.a.)
M. 5/22	...	...	...	- 3.20 t.p.a.	= (32.8 t.p.a.)
M. 7/23	...	...	...	- 1.64 t.p.a.	= (41.3 t.p.a.)
M. 9/24	...	...	...	- 4.47 t.p.a.	= (26.1 t.p.a.)
M. 6/25	...	...	...	- 2.61 t.p.a.	= (42.3 t.p.a.)
M. 14/26	...	...	...	- 2.21 t.p.a.	= (36.1 t.p.a.)
M.109/26	...	...	...	- 3.07 t.p.a.	= (31.6 t.p.a.)
BH.10(12)	...	...	...	- 0.93 t.p.a.	= (45.2 t.p.a.)
Lab.111/14	...	...	...	- 1.55 t.p.a.	= (48.1 t.p.a.)
POJ.2725	...	...	...	- 1.42 t.p.a.	= (38.0 t.p.a.)
POJ.2878	...	...	...	- 1.13 t.p.a.	= (44.0 t.p.a.)
R.P.6	...	...	...	- 1.45 t.p.a.	= (47.0 t.p.a.)
R.P.8	...	...	...	- 1.12 t.p.a.	= (47.2 t.p.a.)

Standard error of difference of experimental plots ... ± 0.51

Date of planting, September-October, 1931. Date of cutting, end of August, 1933.

Conclusions: M.23/16 was significantly better than all the other varieties in the experiment excepting White Tanna, the standard. White Tanna was significantly better than all the remainder excepting BH.10(12).

Notes: (i) Owing to the long virgin crop many of the seedlings in this trial were over-ripe before cutting; (ii) M.6/25 and POJ.2725 were planted from cuttings of poor quality).

TRIAL NO. 16, MON ROCHER S.E. (1ST RATOONS).

	SUCROSE	CANE
Average yield of 25 standard plots of BH.10(12)	5.36 t.p.a.	= (31.0 t.p.a.)
Average difference of 8 plots of:		
POJ.2878 	+ 0.87 t.p.a.	= (38.5 t.p.a.)
POJ.2725 	+ 1.16 t.p.a.	= (39.0 t.p.a.)
M.23/16 	- 1.03 t.p.a.	= (29.0 t.p.a.)
Standard error of difference of experimental plots 	± 0.31	
Date of cutting, 20th November, 1933.		

Conclusions: POJ.2878 and POJ.2725 were significantly better than BH.10(12) thus reversing the results obtained in this trial with virgins. BH.10(12) was again significantly better than M.23/16 however.

TRIAL NO. 17, REDUIT C.E.S. (VIRGINS).

	SUCROSE	CANE
Average yield of 8 standard plots of R.P.8 ...	7.72 t.p.a.	= (62.3 t.p.a.)
Average difference of 6 plots of:		
POJ.2878	- 0.95 t.p.a.	= (50.4 t.p.a.)
POJ.2725	- 1.80 t.p.a.	= (51.2 t.p.a.)
Standard error of difference of experimental plots	± 0.67	
Date of planting, November, 1931. Date of cutting, 28th August, 1933.		

Conclusions: There was no significant difference between R.P.8, the standard, and POJ.2878. R.P.8 however was significantly better than POJ.2725. (*Note:* Owing to shortage of planting material this trial was laid down with single-eye cuttings).

TRIAL NO. 32, MON ROCHER S.E. (VIRGINS).

	SUCROSE	CANE
Average yield of 19 standard plots of BH.10(12)	7.10 t.p.a.	= (40.7 t.p.a.)
Average difference of 3 plots of:		
POJ.2725	- 0.23 t.p.a.	= (45.6 t.p.a.)
POJ.2878	- 1.69 t.p.a.	= (35.6 t.p.a.)
S.C.12/4	- 1.82 t.p.a.	= (35.0 t.p.a.)
Selangor Seedling	- 0.93 t.p.a.	= (38.8 t.p.a.)
M.109/26	+ 0.70 t.p.a.	= (49.8 t.p.a.)
M. 14/26	- 0.61 t.p.a.	= (43.9 t.p.a.)
Standard error of difference of experimental plots	± 0.45	
Date of planting, 24th September, 1932.	Date of cutting, 24th November, 1933.	

Conclusions: No significant difference was to be observed between BH.10(12), the standard, and POJ.2725, M.109/26, and M.14/26. POJ.2878, S.C.12/4, and Selangor Seedling were significantly worse than BH.10(12). M.109/26, although a heavy yielder, is subject to Gummosis.

TRIAL NO. 38, BEAU CHAMP S.E. (VIRGINS).

			SUCROSE	CANE
Average yield of 42 standard plots of White Tanna			2.56 t.p.a.	= (19.2 t.p.a.)
Average difference of 5 plots of:				
BH.10(12)	...	...	+ 0.96 t.p.a.	= (24.4 t.p.a.)
POJ.2878	...	...	+ 2.99 t.p.a.	= (34.9 t.p.a.)
POJ.2725	...	...	+ 1.09 t.p.a.	= (25.1 t.p.a.)
M. 23/16	...	...	+ 1.23 t.p.a.	= (30.9 t.p.a.)
M. 27/16	...	...	+ 0.64 t.p.a.	= (27.8 t.p.a.)
M. 29/16	...	...	+ 1.63 t.p.a.	= (30.4 t.p.a.)
M.109/26	...	...	+ 0.78 t.p.a.	= (25.8 t.p.a.)
M. 14/26	...	...	+ 0.36 t.p.a.	= (27.5 t.p.a.)
Standard error of difference of experimental plots			...	± 0.19

Date of planting, December, 1932. Date of cutting, December, 1933.

Conclusions: All the varieties under trial, except possibly M.14/26, were significantly better in this experiment than White Tanna. This finding bears out previous experience which goes to show the unsuitability of White Tanna for a short virgin crop.

OTHER INVESTIGATIONS.

(i) Storage experiments carried out by the Cane Breeding Officer go to prove that cane fuzz can be kept in a viable condition for as long as nine months when stored in calcium chloride dessicators in an atmosphere of CO_2 . Further experiments in this connection are being carried out.

(ii) The "Rajoengan" method of planting sprouted body-seed, using single-eye cuttings, was tried out on a small scale with success. This method should be of considerable help when multiplying new varieties and is easier to carry out than the method of sprouting single-eye cuttings in pots before planting.

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Senior Geneticist, in charge Sugarcane Research Station.

Réduit,

January, 1934.

LIST OF CROSSES MADE DURING SEASON 1933.

TABLE V.

1. CROSSES BETWEEN " NOBLE " CANES.

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at: C.E.S. P.E.S.	
55.P	x M.23/16	Ebène S.E.	1	31	29	—
55.P	x DK.74	Ebène S.E.	2	1,010	315	—
55.P	x B.3390	Ebène S.E.	1	2	1	—
55.P	x R.P.6	Ebène S.E.	2	100	91	—
131.P	x BH.10(12)	C.E.S.	1	0	0	—
131.P	x BH.10(12)					
	Belle Source S.E.		3	7	—	5
131.P	x DK.74	C.E.S.	1	0	—	—
131.P	x DK.74	Ebène S.E.	2	1	1	—
131.P	x D.109, str.sp.	C.E.S.	1	8	7	—
131.P	x N.G.89	C.E.S.	1	2	2	—
131.P	x M.109/26					
	Belle Source S.E.		1	796	—	380
33/95	x Lab.111/14	C.E.S.	1	53	47	—
55/74	x M.27/16	C.E.S.	1	52	51	—
55/74	x BH.10(12)	C.E.S.	1	0	0	—
55/74	x D.109, white	C.E.S.	1	150	122	—
55/1182	x M.27/16	Ebène S.E.	1	150	120	—
55/1182	x DK.74	Ebène S.E.	2	476	362	—
222/04	x D.109	C.E.S.	1	60	50	—
M.15/16	x M.57/26	C.E.S.	1	14	13	—
M.15/16	x D.109, white	C.E.S.	1	0	0	—
M.20/16	x M.13/18	C.E.S.	2	3	3	—
M.20/16	x DK.74	C.E.S.	1	0	0	—
M.23/16	x 87.P	C.E.S.	1	18	12	—
M.23/16	x 87.P	P.E.S.	2	30	—	21
M.23/16	x 131.P	P.E.S.	1	0	—	0
M.23/16	x 55/453	C.E.S.	1	0	0	—
M.23/16	x 108/05, str.	C.E.S.	1	16	16	—
M.23/16	x 103/06	C.E.S.	1	0	0	—
M.23/16	x M.27/16	Trianon S.E.	2	58	54	—
M.23/16	x M.29/16	P.E.S.	1	20	—	7
M.23/16	x M.35/17	P.E.S.	1	13	—	10
M.23/16	x M.35/17	Trianon S.E.	1	5	5	—
M.23/16	x M.13/18	Trianon S.E.	4	12	11	—
M.23/16	x M.13/18	C.E.S.	1	0	0	—
M.23/16	x M.13/18	P.E.S.	1	30	—	16
M.23/16	x DK.74	C.E.S.	1	17	12	—
M.23/16	x DK.74	P.E.S.	2	51	—	27
M.23/16	x DK.74	Trianon S.E.	2	4	3	—
M.23/16	x D.109, white	C.E.S.	1	40	37	—
M.23/16	x D.109, white	P.E.S.	2	266	104	88
M.23/16	x D.109, str.	C.E.S.	1	82	80	—
M.23/16	x Lab.111/14	C.E.S.	1	125	111	—
M.23/16	x N.G.89	C.E.S.	1	92	83	—
M.23/16	x BH.10(12)	P.E.S.	3	1	—	0
M.23/16	x Senneville	P.E.S.	1	1	—	0
M.29/16	x M.27/16	Trianon S.E.	2	32	27	—
M.29/16	x M.13/18	Trianon S.E.	2	211	184	—
M.29/16	x DK.74	Trianon S.E.	2	17	15	—
M.29/16	x DK.74	P.E.S.	1	604	—	253
M.1/17	x DK.74	Trianon S.E.	1	850	288	—
M.17/18	x DK.74	P.E.S.	1	5	—	3
M.18/18	x D.109, str.	C.E.S.	1	30	26	—
M.33/19	x M.27/16	C.E.S.	1	1	1	—
M.33/19	x DK.74	C.E.S.	3	197	191	—
M.33/19	x BH.10(12)	P.E.S.	2	70	—	58
M.33/19	x Senneville	P.E.S.	2	2,696	—	395
M.26/20	x BH.10(12)					
	Mon Rocher S.E.		1	199	—	154

1. CROSSES BETWEEN " NOBLE " CANES—*continued*

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at: C.E.S. P.E.S.	
M.26/20	x DK.74	Mon Rocher S.E.	2	1,152	—	583
M.26/20	x D.109, white	Mon Rocher S.E.	1	400	—	222
M.26/20	x M.23/16	Mon Rocher S.E.	1	0	—	0
M.26/20	x M.29/16	Mon Rocher S.E.	1	850	—	414
M.26/20	x M.13/18	Mon Rocher S.E.	1	47	—	41
M.14/26	x M.27/16	Trianon S.E.	2	0	0	—
M.14/26	x M.13/18	Trianon S.E.	1	0	0	—
M.14/26	x DK.74	Trianon S.E.	2	0	0	—
M.109/26	x M.27/16	Ebène S.E.	2	1,640	406	270
M.109/26	x M.29/16	C.E.S.	1	0	0	—
M.109/26	x M.13/18	Ebène S.E.	2	2,743	458	—
M.109/26	x DK.74	Ebène S.E.	2	1,550	253	—
M.109/26	x DK.74	C.E.S.	1	320	156	—
M.26/31	x DK.74	Ebène S.E.	1	8	8	—
M.34/27	x D.109, white	Mon Rocher S.E.	1	250	—	186
Bambou Rayée	x M.27/16	C.E.S.	1	50	49	—
Bambou Rayée	x M.17/24	C.E.S.	1	517	156	—
Bambou Rayée	x DK.74	C.E.S.	1	3	3	—
Bambou Rayée	x D.1135	C.E.S.	1	88	86	—
Bambou Rose	x M.29/16	C.E.S.	1	0	0	—
Bambou Rose	x M.13/18	C.E.S.	1	0	0	—
Bambou Rose	x M.57/26	C.E.S.	1	0	0	—
Bambou Rose	x 87.P	C.E.S.	1	0	0	—
Fotiogo	x 87.P	C.E.S.	1	1	1	—
Fotiogo	x M.27/16	C.E.S.	1	48	34	—
Fotiogo	x DK.74	C.E.S.	1	4	4	—
Fotiogo	x D.1135	C.E.S.	1	1	1	—
Gros Genoux	x M.23/16	C.E.S.	1	24	23	—
Gros Genoux	x DK.74	C.E.S.	2	118	107	—
Iscambine	x M.27/16	C.E.S.	1	0	0	—
Lab. No. 1	x M.27/16	C.E.S.	1	0	0	—
Lab. No. 1	x D.109, white	C.E.S.	1	20	20	—
Louzier	x 87.P	C.E.S.	1	6	6	—
Louzier	x M.27/16	C.E.S.	1	243	206	—
Louzier	x DK.74	C.E.S.	2	35	27	—
Louzier	x BH.10(12)	C.E.S.	1	0	0	—
Louzier	x Lab.111/14	C.E.S.	1	58	56	—
Mapou Perlée	x 87.P	C.E.S.	1	95	90	—
Mapou Perlée	x M.27/16	C.E.S.	2	300	278	—
Mapou Perlée	x BH.10(12)	C.E.S.	1	0	0	—
Mignonne	x M.27/16	C.E.S.	1	41	35	—
Mignonne	x DK.74	C.E.S.	1	20	13	—
Penang	x M.27/16	C.E.S.	1	1,454	516	—
Tanna M/ Désertx	M.27/16	Ebène S.E.	2	0	0	—
Tanna M/ Désertx	DK.74	Ebène S.E.	2	0	0	—
Ba.11569	x M.29/16	C.E.S.	2	21	20	—
Ba.11569	x DK.74	C.E.S.	1	70	62	—
DK.74	x M.27/16	Trianon S.E.	2	428	361	—
DK.74	x M.13/18	Trianon S.E.	2	375	320	—
DK.74/70	x D.109, str.	C.E.S.	1	73	73	—
D.117	x M.27/16	C.E.S.	1	0	0	—
D.117	x M.29/16	C.E.S.	1	0	0	—
D.117	x DK.74	C.E.S.	1	0	0	—
N.G.89	x M.27/16	C.E.S.	1	9	7	—
R.P.6	x 55.P	Trianon S.E.	1	1	1	—
R.P.6	x 87.P	Trianon S.E.	2	220	204	—
R.P.6	x 131.P	Maison Blanche	1	14	—	12
R.P.6	x M.23/16	Ebène S.E.	3	595	429	—
R.P.6	x M.23/16	C.E.S.	1	200	180	—
R.P.6	x M.27/16	C.E.S.	1	1,563	156	—

1. CROSSES BETWEEN " NOBLE " CANES—*continued*

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at:	
					C.E.S.	P.E.S.
R.P.6	x M.27/16	Ebène S.E.	1	815	200	—
R.P.6	x M.27/16	Trianon S.E.	1	205	200	—
R.P.6	x M.29/16	C.E.S.	1	0	0	—
R.P.6	x M.35/17	Maison Blanche	1	718	—	468
R.P.6	x M.13/18	Trianon S.E.	2	991	245	—
R.P.6	x M.13/18	Maison Blanche	1	190	—	144
R.P.6	x M.12/21	Trianon S.E.	1	360	206	—
R.P.6	x BH.10(12)	C.E.S.	1	0	0	—
R.P.6	x BH.10(12)	Maison Blanche & Beau Plan S.E.	4	32	—	23
R.P.6	x DK.74	C.E.S.	1	350	256	—
R.P.6	x DK.74	Trianon S.E.	2	985	366	100
R.P.6	x DK.74	Maison Blanche and Beau Plan S.E.	8	4,790	—	400
R.P.6	x D.109	Maison Blanche	1	750	—	468
R.P.6	x D.109, white	C.E.S.	1	238	171	—
			1	676	—	456
R.P.6	x D.109, white	Maison Blanche	1	676	—	456
R.P.6	x D.109, str.	Maison Blanche	3	2,190	—	600
R.P.6	x Lab.111/14	C.E.S.	1	38	35	—
R.P.6	x N.G.89	C.E.S.	1	1	1	—
R.P.6 str.	x M.29/16	C.E.S.	1	17	15	—
TOTAL...			187	37,709	8,968	6,263

2. INTER-SPECIFIC CROSSES.

1. 1ST NOBILISED GLAGAH:

Glagah Kloet	x D.109	C.E.S.	1	0	0	—
Glagah Kloet	x M.27/16	C.E.S.	1	0	0	—
Glagah Tobango	x DK.74	C.E.S.	1	0	0	—
Louzier	x Glagah Kloet	C.E.S.	1	5	5	—
Mignonne	x Glagah Kloet	C.E.S.	1	9	9	—
TOTAL...			5	14	14	—

II. 2ND NOBILISED GLAGAH:

131.P	x MZ.8/30	C.E.S.	1	474	150	—
Louzier	x Kassoer	C.E.S.	1	2	2	—
Kassoer	x M.27/16	C.E.S.	2	0	0	—
Kassoer	x DK.74	C.E.S.	1	0	0	—
Kassoer	x D.109	R.B.G.	1	6	—	0
Kassoer	x D.109, str.	C.E.S.	1	0	0	—
TOTAL...			7	482	152	—

III. 3RD NOBILISED GLAGAH: ...

1931 Seedg.*	x MX.2/30	Belle Source S.E.	1	6	—	4
Bambou Rayée	x MX.2/30	C.E.S.	1	25	20	—
Bois Rouge	x MX.2/30	C.E.S.	1	70	64	—
Mapou Perlée	x MX.2/30	C.E.S.	1	5	5	—

* M.33/19 x D.109, striped sport.

2. INTER-SPECIFIC CROSSES—continued

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at: C.E.S. P.E.S.	
Mapou Perlée	x MX.3/30	P.E.S.	1	4	—	4
POJ.2364	x 87.P	C.E.S.	2	1,381	200	—
POJ.2364	x 87.P	P.E.S.	1	548	—	348
POJ.2364	x 131.P	P.E.S.	1	22	—	18
POJ.2364	x M.17/24	C.E.S.	4	641	200	82
POJ.2364	x M.57/26	C.E.S.	2	226	51	—
POJ.2364	x D.109	P.E.S.	3	205	—	144
POJ.2364	x D.109, str.	P.E.S.	3	390	—	323
POJ.2364	x D.1135	C.E.S.	1	30	29	—
POJ.2364	x DK.74	P.E.S.	1	33	—	29
POJ.2364	x Senneville	P.E.S.	1	180	—	118
POJ.2364	x BH.10(12)	P.E.S.	3	42	—	37
131.P	x MX.2/30					
	Belle Source S.E.		1	33	—	23
TOTAL...			28	3,871	569	1,130

IV. 4TH NOBILISED GLAGAH:

55.P	x POJ.2878	Ebène S.E.	4	36	36	—
131.P	x POJ.2878	Ebène S.E.	2	1	1	—
55/1182	x POJ.2878	Ebène S.E.	3	2	2	—
M.23/16	x POJ.2878	Trianon S.E.	4	20	13	—
M.29/16	x POJ.2878	Trianon S.E.	2	10	10	—
M.14/26	x POJ.2878	Trianon S.E.	2	0	0	—
M.109/26	x POJ.2878					
	Mon Rocher S.E.		2	762	—	498
Black Chérillon	x POJ.2878	C.E.S.	1	15	9	—
Louzier	x POJ.2878	C.E.S.	1	10	8	—
R.P.6	x POJ.2878	Ebène S.E.	2	51	50	—
R.P.6	x POJ.2878	Trianon S.E.	2	80	79	—
R.P.6	x POJ.2878					
	Maison Blanche		1	95	—	89
R.P.6	x Selangor Seedling	C.E.S.	1	1	1	—
POJ.2725	x D.109, white					
	Mon Rocher S.E.		1	5	—	3
POJ.2878	x 55.P	Trianon S.E.	2	19	17	—
POJ.2878	x 87.P	C.E.S.	3	448	258	—
POJ.2878	x 87.P	Mon Rocher S.E.	3	5,300	—	700
POJ.2878	x 131.P	Mon Rocher S.E.	2	254	—	234
POJ.2878	x 55/1182	Ebène S.E.	2	13	13	—
POJ.2378	x 108/05	C.E.S.	1	0	0	—
POJ.2878	x 103/06	C.E.S.	1	4	3	—
POJ.2878	x M.17/16	Ebène S.E.	2	10	9	—
POJ.2878	x M.23/16	Ebène S.E.	2	173	162	—
POJ.2878	x M.23/16					
	Mon Rocher S.E.		1	85	—	63
POJ.2878	x M.27/16	Ebène S.E.	1	5	5	—
POJ.2878	x M.27/16	Trianon S.E.	2	75	72	—
POJ.2878	x M.27/16	C.E.S.	1	6	4	—
POJ.2878	x M.27/16					
	Mon Rocher S.E.		1	22	—	15
POJ.2878	x M.29/16	Trianon S.E.	2	53	52	—
POJ.2878	x M.35/17					
	Mon Rocher S.E.		3	149	—	134
POJ.2878	x M.13/18					
	Mon Rocher S.E.		3	177	—	144
POJ.2878	x M.13/18	Trianon S.E.	2	60	56	—
POJ.2878	x M.13/18	C.E.S.	1	0	0	—
POJ.2878	x M.2/19					
	Mon Rocher S.E.		1	1	—	0

2. INTER-SPECIFIC CROSSES—*continued*

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at: C.E.S. P.F.S.	
POJ.2878	x M.5/19	Mon Rocher S.E.	1	0	—	0
POJ.2878	x M.12/21	Trianon S.E.	1	63	61	—
POJ.2878	x M.17/24	C.E.S.	1	0	0	—
POJ.2878	x M.109/26	Ebène S.E.	1	1	1	—
POJ.2878	x M.49/27	Mon Rocher S.E.	1	1	—	1
POJ.2878	x M.74/27	Mon Rocher S.E.	1	434	—	371
POJ.2878	x M.101/27	Mon Rocher S.E.	1	55	—	48
POJ.2878	x Iscambine	C.E.S.	1	0	0	—
POJ.2878	x BH.10(12)	C.E.S.	2	4	4	—
POJ.2878	x BH.10(12)	Mon Rocher S.E.	6	90	—	81
POJ.2878	x DK.74	C.E.S.	2	11	7	—
POJ.2878	x DK.74	Trianon S.E.	3	475	395	—
POJ.2878	x DK.74	Mon Rocher S.E.	3	133	—	104
POJ.2878	x DK.74, str.	Mon Rocher S.E.	1	36	—	32
POJ.2878	x D.109	Mon Rocher S.E.	1	34	—	24
POJ.2878	x D.109, white	Mon Rocher S.E.	3	253	—	186
POJ.2878	x D.109, white	C.E.S.	1	33	32	—
POJ.2878	x D.1135	C.E.S.	2	205	155	—
POJ.2878	x N.G.89	C.E.S.	3	25	20	—
POJ.2878	x S.C.12/4	Mon Rocher S.E.	1	1	—	0
POJ.2878	x Senneville	Mon Rocher S.E.	3	82	—	47
POJ.2725	x 87.P	C.E.S.	1	150	120	—
POJ.2725	x M.29/16	C.E.S.	1	3	3	—
POJ.2725	x M.57/26	C.E.S.	1	7	5	—
POJ.2725	x DK.74	C.E.S.	1	0	0	—
POJ.2725	x D.109, white	C.E.S.	1	3	2	—
POJ.2725	x D.1135	C.E.S.	2	7	5	—
White Tanna						
Mon Désert	x POJ.2878	Mon Rocher S.E.	1	0	—	0
131.P	x Selangor Seedling	C.E.S.	1	0	0	—
M.23/16	x Selangor Seedling	C.E.S.	1	0	0	—
Louzier	x Selangor Seedling	C.E.S.	1	2	2	—
Mapou Perlée	x Selangor Seedling	C.E.S.	1	1	1	—
TOTAL...			116	10,151	1,673	2,773

V. 5TH NOBILISED GLAGAH:

131.P	x POJ.2940	Belle Source S.E.	1	83	—	53
131.P	x POJ.2940	C.E.S.	1	100	96	—
Bambou Rayée	x POJ.2940	C.E.S.	1	0	0	—
TOTAL...			3	183	96	53

VI. SACCHARUM-SINENSE CROSSES:

Uba	x M.27/16	C.E.S.	2	0	0	—
Uba	x DK.74	C.E.S.	3	1	1	—
White Uba	x 87.P	C.E.S.	1	500	150	221
White Uba	x N.G.89		1	0	0	—

2. INTER-SPECIFIC CROSSES—*continued*

COMBINATION		Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at:	
					C.E.S.	P.E.S.
Uba Seedg.	x N.G.89	C.E.S.	1	5	5	—
131.P	x Uba Marot	C.E.S.	1	150	104	—
55/1182	x Uba Marot	Ebène S.E.	2	8	8	—
M.23/16	x Uba Marot	Trianon S.E.	2	7	6	—
M.23/16	x Uba Marot	P.E.S.	2	10	—	5
M.29/16	x Uba Marot	Trianon S.E.	2	2	1	—
M.33/19	x R.F. No. 2	C.E.S.	1	0	0	—
M.109/26	x R.F. No. 2	C.E.S.	1	10	9	—
M.109/26	x Uba Marot	Ebène S.E.	1	0	0	—
M.109/26	x Uba Marot	Mon Rocher S.E.	2	91	—	48
M.26/20	x Uba Marot	Mon Rocher S.E.	1	20	—	16
55/1182	x R.F. No. 2	Ebène S.E.	1	0	0	—
Fotiogo	x R.F. No. 2	C.E.S.	1	0	0	—
Fotiogo	x Uba Marot	C.E.S.	1	6	6	—
Gros Genoux	x Uba Marot	C.E.S.	1	11	10	—
Louzier	x Uba Marot	C.E.S.	1	4	0	—
Mapou Perlée	x Uba Marot	C.E.S.	2	50	43	—
Mignonne	x Uba Marot	C.E.S.	1	5	4	—
Penang	x Uba Marot	C.E.S.	1	250	206	—
DK.74	x Uba Marot	Trianon S.E.	2	0	0	—
Tambiapen	x Uba Marot	P.E.S.	1	222	—	184
White Tanna						
Mon Désert	x Uba Marot	Mon Rocher S.E.	1	2	—	2
R.P.6	x Uba Marot	Maison Blanche	1	151	—	134
R.P.6	x Uba Rich Fund	Beau Plan S.E.	1	12	—	10
TOTAL ...			38	1,520	553	620

VII. CHUNNEE CROSSES:

POJ.36	x 87.P	C.E.S.	1	0	0	—
POJ.36	x M.29/16	C.E.S.	1	0	0	—
POJ.36	x M.113/26	C.E.S.	2	0	0	—
POJ.36	x BH.10(12)	C.E.S.	1	0	0	—
POJ.36	x DK.74	C.E.S.	2	1	1	—
POJ.36	x D.1135	C.E.S.	1	0	0	—
POJ.161	x M.27/16	C.E.S.	1	0	0	—
POJ.161	x DK.74	C.E.S.	1	0	0	—
131.P	x POJ.161	C.E.S.	1	536	150	—
M.15/16	x POJ.161	C.E.S.	1	0	0	—
M.23/16	x POJ.161	C.E.S.	1	0	0	—
M.109/26	x POJ.161	C.E.S.	2	7	6	—
55/74	x POJ.161	C.E.S.	1	5	5	—
Louzier	x POJ.161	C.E.S.	1	0	0	—
Penang	x POJ.161	C.E.S.	1	112	102	—
Ba. 11569	x POJ.161	C.E.S.	1	4	3	—
POJ.213	x M.37/26	C.E.S.	1	0	0	—
TOTAL ...			20	665	267	—

VIII. OTHER COMBINATIONS:

M.23/16	x Seedg. 1302/31 *	P.E.S.	1	19	—	11
131.P	x Seedg. 1405/31 †	Belle Source S.E.	1	125	—	107

* POJ.2878 x Uba Marot.

† POJ.2878 x Uba Marot.

2. INTER-SPECIFIC CROSSES—*continued*

COMBINATION	Location of Cross	No. of crosses made	No. of seedlings obtained	No. of seedlings potted at:	
				C.E.S.	P.E.S.
55/1182	x Ebène Seedg./31				
	Ebène S.E.	1	71	69	—
R.P.6	x Trianon Seedg.20/31				
	Trianon S.E.	1	0	0	—
R.P.6	x Trianon Seedg.29/31				
	Trianon S.E.	1	27	25	—
Bois Rouge	x Saccharum Munja				
	C.E.S.	1	134	64	—
POJ.36	x R.F. No.2	C.E.S.	1	0	—
POJ.2725	x Uba Marot	C.E.S.	1	102	100
POJ.2878	x Uba Marot	C.E.S.	1	100	80
POJ.2878	x Uba Marot	Ebène S.E.	2	950	520
POJ.2878	x Uba Marot				
	Mon Rocher S.E.&P.E.S.	5	7,010	—	700
POJ.2878	x Uba Rich Fund				
	Mon Rocher S.E.	1	756	256	500
POJ.2878	x Saccharum Munja				
	Mon Rocher S.E.	1	11	—	9
Total...		18	9,305	1,114	1,327

3. INTERGENERIC CROSSES.

131.P	x Sorghum	C.E.S.	1	0	—
131.P	x Sorghum				
	Belle Source S.E.	1	6	—	6
M.33/19	x Sorghum	P.E.S.	2	1	0
M.33/19	x Sorghum	C.E.S.	1	0	—
POJ.2364	x Sorghum	C.E.S.	1	0	—
POJ.2725	x Sorghum	C.E.S.	1	0	—
POJ.2878	x Sorghum				
	Mon Rocher S.E.	1	968	—	300
R.P.6	x Sorghum				
	Maison Blanche	1	132	—	90
TOTAL...		9	1,107	—	396

VARIETY	Location	No. of selfings made	No. of seedlings obtained	No. of seedlings potted at:	
				C.E.S.	P.E.S.

4. SELFINGS.

M.23/16	P.E.S.	2	23	—	19
M.29/16	P.E.S.	1	5	—	0
M.33/19	P.E.S.	1	0	—	0
M.2620	Mon Rocher S.E.	1	6	—	0
M.109/26	Mon Rocher S.E.	1	0	—	0
POJ.2364	P.E.S.	1	14	—	0
POJ.2878	Mon Rocher S.E.	2	8	—	0
131.P	Belle Source S.E.	1	5	—	0
TOTAL...		10	61	—	19

5. UNCONTROLLED POLLINATION.

M.23/16	P.E.S.	1	5	—	0
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6. EXTRA SEEDLINGS FROM FUZZ RECEIVED FROM HAWAII.

Mol.1694	x 27.C.445	Hawaii	—	—	22	—
26.C.148	x Mol. 1694	Hawaii	—	—	8	—
26.C.148	x Mol. 2154	Hawaii	—	—	13	—
TOTAL...		—	—	—	43	—

PART II. BIO-CHEMISTRY.

SOILS.

The greater part of the work under this heading was done during the first six months of the year and consequently an account of it already appears in the Seventh Progress Report, which, however, is printed for private circulation only. Consequently an account is again given in this Annual Report.

AVAILABLE POTASH.

This series of determinations was completed and the results definitely show that the amount of exchangeable potash present in the cultivated soils is dependent upon the rainfall of the area in which the soil is situated. Thus, as the rainfall increases the amount of plant food in the soil progressively decreases until, in the regions of high precipitation, only very small quantities, as low as 0.004% of potash, are present. The crop in these regions is therefore dependent, in a large degree, for its supply of this essential plant food upon the annual applications of potash in the form of fertilisers or molasses. This poverty of the high leached soils is fully borne out by the results of the Potash Manurial Trials at Rich Fund S.E. and at Sans Souci S.E. The only soils which may be considered to be well supplied in this element are those from the hot, dry districts, such as Black River, Pamplémousses and Rivière du Rempart. There is a distinct relationship between the amounts of potash soluble in strong hydrochloric acid and that in the exchangeable form, and generally between 25 and 50% of the former is present in the latter state of combination.

COMPOSITION OF THE CLAY FRACTION.

The calculation of molecular *silica/alumina* ratios from the analysis of the whole soil is open to certain criticisms, in that it takes into account the unweathered minerals present in the soil, and also any quartz which is present is considered as combined silica. These are not important considerations in the mature soils of Mauritius, in which there are few if any unweathered minerals, and quartz is present only in special cases. Another point is that many investigators have used this ratio for the clay fraction only, so that the results of these clay analyses will enable soils in other tropical countries to be the more easily compared with those of this Colony.

The clay fractions selected for analysis had been separated during the mechanical analysis and had therefore undergone the pre-treatment with hydrogen peroxide and hydrochloric acid, but it is not considered that this will have affected the constitution of the clay, except as regards the exchangeable bases. These analyses were performed by the fusion method, and the results are given in Table I, together with the molecular *silica/alumina* ratio for the whole soil, obtained by the methods previously described.

TABLE I.

BULK ANALYSIS OF THE CLAY FRACTION FROM CERTAIN SELECTED SOILS.

Soil No	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	H ₂ O(+)	O.M.	Mol. SiO ₂	Mol. SiO ₂	Mol. SiO ₂ *
							Mol. Fe ₂ O ₃ + Al ₂ O ₃	Mol. Al ₂ O ₃	Mol. Al ₂ O ₃
25	5.5	33.0	36.2	4.9	18.2	0.6	0.17	0.28	0.36
45	5.2	32.6	37.5	3.6	19.8	1.1	0.15	0.27	0.42
92	10.1	30.6	30.9	4.0	18.8	1.2	0.34	0.56	0.48
21	18.6	34.1	26.5	2.5	15.3	2.8	0.62	0.95	1.25
35	18.7	33.7	27.1	4.1	17.9	1.0	0.62	0.94	1.28
87	19.4	35.6	26.5	3.2	16.0	1.3	0.63	0.93	1.03
65	31.0	33.6	19.8	1.7	12.5	1.4	1.14	1.57	1.69
71	30.1	32.8	20.6	1.2	14.5	3.5	1.12	1.56	1.84
77	27.3	24.3	21.6	2.2	16.0	4.8	1.13	1.91	1.69
59	27.0	35.5	17.1	1.9	14.5	1.5	1.00	1.30	2.35
78	26.9	27.0	18.3	1.6	16.9	1.9	1.19	1.70	3.02
90	24.3	30.9	20.3	2.4	17.2	1.8	0.94	1.34	1.77

From these figures it will be seen that as far as the soils free from stones and gravel, i.e. the mature soils, are concerned, the molecular *silica/alumina* ratios of the clay fraction and of the whole soil are comparable, that of the clay fraction being somewhat lower than that of the whole soil with one exception. In the case of the mature soils, either ratio is equally suitable for characterising the soil under consideration. In the case of the rocky or immature soils, the position is somewhat different as this ratio for the clay is considerably less than that for the whole soil, probably because this class of soil contains a fairly high proportion of unweathered minerals, which occur in the sand fractions. From a consideration of the molecular *silica/alumina* ratio for the whole soil, these dark-brown rocky soils cannot be considered as lateritic soils, but the clay analysis indicates that this fraction has undergone the process of laterisation to about the same extent as, or even more than, the clay of the typical red soils.

These results emphasise the extreme degree to which the yellow soils of the high rainfall regions have undergone the process of laterisation. There is no doubt that naturally they are highly impoverished, and it is only by good treatment, both cultural and manurial, that they can be expected to give good crops. One point in their favour is the plentiful water supply, which may enable the growing crop to make the most economical use of the plant foods present in the soil.

The figure of the organic matter is of little importance, except that it enables the combined moisture to be calculated. In soils 71 and 77 the amount of this constituent is somewhat high, and this is due in all probability to the fact that these soils contain much manganese dioxide, which has

NOTES: * Ratio calculated from the results obtained by extraction with concentrated hydrochloric acid on the whole soil.

Soils 25, 45 and 92 are yellow soils of the most highly laterised type, free from stones and gravel.

Soils 21, 35 and 87 are yellowish-brown soils of the intermediate type, free from stones and gravel.

Soils 65, 71 and 77 are red soils of least laterised type, free from stones and gravel.

Soils 59, 78 and 90 are dark-brown soils, with a greyish tinge, containing a high percentage of rocks and gravel.

catalytically reduced the hydrogen peroxide during the pre-treatment. The variation in the combined moisture content of the clays is not so marked as for the whole soils. This is probably accounted for by the fact that the sand fractions in the dark-brown rocky-soil type and the yellow-soil type are of totally different characters, that of the former containing little combined water, whereas that of the latter contains much.

FINE SAND FRACTION.

There are two totally different types of soil which contain appreciable quantities of fine sand, namely the dark-brown rocky soils and the highly laterised yellow soils. It is evident to the naked eye that the sand fractions from these two types of soil are totally different, that from the former consisting of partially weathered rock particles and that from the latter of concretions, which, by repeated rubbing, can be further broken down. Consequently two samples from each type were analysed by the fusion method, the results being given in Table II.

TABLE II.

BULK ANALYSIS OF THE FINE SAND FRACTION FROM CERTAIN
SELECTED SOILS.

Soil No	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	Molecular	Molecular
				$\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$	$\frac{\text{SiO}_2}{\text{Fe}_2\text{O}_3}$
25	6.0	18.8	38.2	0.26	0.20
45	3.7	19.7	43.3	0.14	0.12
59	37.4	15.3	22.7	2.81	1.95
78	34.8	17.7	15.3	3.86	2.23

NOTES: Soils 25 and 45 are yellow soils free from stones.

Soils 59 and 78 are dark-brown soils, with a greyish tinge, containing a high proportion of stones and gravel.

When these analyses are compared with the analyses of the corresponding clay fractions, it can be seen that whereas the silica content remains practically constant in the case of the yellow soils, the silica content of the sand fraction of the brown soils is considerably higher than that of the clay fraction. The concretions from the yellow soils contain considerably less Fe₂O₃ and considerably more Al₂O₃ than do the clays, whereas the sands from the others contain only slightly less Fe₂O₃, but much less Al₂O₃ than the corresponding clays. As a result we find that the molecular *silica/alumina* ratio for the former to be extremely low, but for the latter it is moderately high.

The sand fractions of the highly-leached soils may be regarded as a very advanced stage in the lateritic decomposition of the parent rock material, more advanced even than that of the clay fraction, so that it is not likely to be of much value to a plant from the nutritional point of view. This fraction in the brown soils, however, represents an intermediate stage in the decomposition and may consequently be regarded as a potential source of plant food material during its further decomposition.

STABILITY OF THE SOIL AGGREGATES.

This investigation formed the subject for a short paper read by my assistant, Mr. P. Halais, to a meeting of the Former Students Association of the Mauritius Agricultural College.

The method employed was to shake 10 grs. of soil with 500 ccs. of water in a mechanical shaker for definite periods of time, and afterwards to determine the amount of coarse material remaining, more than 0.02 mm. in diameter, by the pipette method.

Five soils from widely-scattered districts were chosen for this investigation, and a sixth from the " Vallée des Prêtres " was added, as being of a totally different type. This soil is grey and very hard when air dry, but on wetting it becomes almost black in colour, when it is very sticky. The few analyses performed are given in Table III.

TABLE III.

SOIL FROM VALLEE DES PRETRES.

Stones and gravel: 25%

<i>Mechanical Analysis</i>			<i>Exchangeable Bases</i>		
Clay	...	49.6%	S	...	45.4 m.eqs.
Silt	...	27.7%	Ca	...	27.5 m.eqs.
Fine sand	...	12.7%	Ca%S	...	61%
Coarse sand	...	4.6%	pH	...	6.45
Organic matter	...	5.4%			
H ₂ O (+ -)	...	8.0%			

Available Constituents.

1% Citric soluble P ₂ O ₅	...	0.082%
1% Citric soluble Fe ₂ O ₃	...	0.55%

These results show that this soil has very different properties from those previously considered. The total base exchange capacity at pH 7.0 judged from the sum of the bases at pH 6.45 would seem to be very high, in the neighbourhood of 60 m.eqs. The combined water is low, the soil colloids are of a very sticky nature when wet and the amount of citric soluble phosphate is very high. The soil is therefore probably of a more siliceous type than those already examined.

All the normal soils have a very much more stable crumb structure than this soil, when judged from the results of this experiment. Whereas the reduction in aggregates in soils 6 and 73 as the result of 105 minutes mechanical shaking is from 94% and 93% to 92% and 90% respectively, the reduction in the case of the Vallée des Prêtres soil is from 82% to 43%. The reduction with soil 78, i.e. a very rocky, dark-brown soil, is in the same period from 72% to 60%, i.e. it is intermediate between the above-mentioned types. The high stability of the crumb structures is probably a very important factor in the economy of the highly-laterised types, and is no doubt partly responsible for their free drainage, freedom from erosion, and their easy-working properties.

FIXATION OF PHOSPHATES.

All soils have the property of fixing added phosphates and this power is possessed to a marked extent by lateritic soils, so much so that they are recognised as phosphorus-hungry soils. That Mauritius soils have this power to a high degree is shown by the fact that of the total phosphorus present only a very small percentage is in a form readily available for plant growth.

Consequently their specific power in this direction was determined by the method of Demolon and Barbier, which is a method based on the fixation of phosphate in 1% acetic acid solution.

The results show that in all the normal cultivated soils this fixation is extremely great, amounting to between 98 and 99% when the amount of P_2O_5 extracted from the untreated soil by means of 1% acetic acid (soil/acid ratio = 1/10) is nil. When an initial concentration of phosphorus oxide is found, however, then the power of retention is not so great, amounting in the case of soil 63 to 87%. Again the retention in these soils show no direct relationship with this amount added, but it is always seen that the retention is relatively greater with the smaller application.

Conditions are very different, however, in the case of the soil from "Vallée des Prêtres," in which the retained phosphorus bears a direct relationship to the amount added, the former being about 67% of the latter.

Although acetic acid extracts much less phosphoric oxide from the soil when used in the above-mentioned soil acid ratio than is found by either Dyer's or Truog's methods, yet if this ratio is increased to 1/400 then the amounts extracted by the three methods are of the same order. Although the accuracy of the determination is decreased by such a high dilution, yet it has the advantage that no iron is rendered soluble, so that the P_2O_5 in the extract can be determined directly by the colorimetric method as in Truog's method.

These results clearly indicate that there is little or no possibility of phosphates moving about in the soil or of being removed in the drainage water. It would therefore seem that for phosphates to give their maximum effect, they should be thoroughly incorporated with the soil during the various cultural operations.

ANALYSIS OF A SOIL PROFILE AT THE CENTRAL EXPERIMENT STATION.

Advantage was taken of the digging of a deep pit by the Physiological Botanist in the course of an examination of the rooting system of a stool of sugarcane, to investigate the soil profile. The field in question is very even, with a very gentle slope towards the west, and there is no danger of soil having been transported there in the past, as there are no hills in the vicinity. This field has been planted with sugarcane for a number of years.

The surface soil is a typical free soil of a medium degree of laterisation. The surface layer is rather shallow, of a depth of about 7 inches, possesses a good crumb structure and is of a brown colour. The line of demarkation between the soil and subsoil is definite and this is the only depth at which any quick change could be seen; below this depth the change in colour is gradual, from a brownish-yellow, through a yellowish-red to red, and it has a friable nature. In the layer from 7 to 18 inches there are very few black shot-like particles, which become more numerous and larger in size in the deeper layers. These particles have the property of decomposing hydrogen peroxide in the cold. In this actual profile no large stones were found, but near-by stones of various sizes were seen in the various layers, the sizes varying from a few inches to three or four feet in diameter. When these stones were broken, they showed on the outside a crust of weathered rock material of a yellow earthy appearance, about an inch in thickness, whilst the inner part consisted of unweathered doleritic basalt.

The description of the various samples is given in Table IV and the results of analyses in Tables V to VII:

TABLE IV.

DESCRIPTION OF SAMPLES.

Depth	Colour in the field	Structure in the field	Observations
0-7 ins.	Brown	Crumb	A few black shot-like particles seen. A fair number of shot-like particles up to $\frac{1}{4}$ " diam, and black in colour, possessing the power to decompose hydrogen peroxide in the cold.
7-18 ins.	Brownish-yellow	Friable	
18-30 ins.	Yellowish-red	Friable	
30-48 ins.	Red	Friable	

TABLE V.

MECHANICAL ANALYSIS WITH PH VALUES AND EASILY SOLUBLE P_2O_5 BY TRUOG'S METHOD.

Depth	Coarse sand	Fine sand	Silt	Clay	Organic Matter	pH value	Easily sol P_2O_5 by Truog's Method
0-7 ins.	1.0	4.0	16.3	74.6	4.1	6.3	0.0044
7-18 ins.	0.1	1.6	9.3	87.6	1.4	6.3	0.0002
18-30 ins.	0.1	3.5	14.3	81.4	0.7	6.1	0.0002
30-48 ins.	0.2	13.3	22.0	64.0	0.5	6.2	0.0003

TABLE VI.

CHEMICAL ANALYSIS OF THE SOIL, BY THE TRI-ACID METHOD OF HARDY AND FOLLETT-SMITH.

Depth	"Quartz"	"Combined" SiO_2	Fe_2O_3	Al_2O_3 + TiO_2	$H_2O(+)$	Molecular combined	
						$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{R_2O_3}$
0-7 ins.	9.0	22.0	22.1	27.9	12.1	1.34	0.89
7-18 ins.	4.4	25.6	23.4	32.9	13.1	1.32	0.91
18-30 ins.	1.4	28.0	23.8	34.1	13.3	1.40	0.97
30-48 ins.	0.7	26.4	24.0	36.1	13.9	1.23	0.87

TABLE VII.

BULK ANALYSIS OF THE CLAY FRACTION BY FUSION.

Depth	SiO_2	Fe_2O_3	Al_2O_3 + TiO_2	$H_2O(+)$	Organic Matter	Molecular $\frac{SiO_2}{Al_2O_3}$	Molecular $\frac{SiO_2}{R_2O_3}$
0-7 ins.	28.1	23.5	34.3	15.2	0.4	1.38	0.96
7-18 ins.	29.4	21.9	36.0	15.8	0.3	1.38	1.00
18-30 ins.	29.8	20.8	37.0	16.1	0.3	1.37	1.01
30-48 ins.	28.9	20.8	33.2	15.8	0.3	1.47	1.05

The pH figures given in Table V show that there is no zone of accumulation of calcium carbonate down to a depth of 4 feet. The immobility of phosphoric oxide in the soil is further evinced by the amounts present in the various layers, and it would seem that the small amounts of easily-soluble phosphate in the lower layers are derived from the original rock material, the higher amount in the surface soil being due to repeated applications of phosphatic fertilisers, which have failed to penetrate to any depth. The high amounts of clay in the layers 7 to 18 inches, 18 to 30 inches, is probably due to the washing down of some of the fine particles from the surface, but below a depth of 30 inches, there does not seem to have any penetration of these particles. The organic matter also is chiefly concentrated in the surface layer, the content progressively falling at the greater depths. It is thus seen that as regards organic matter and phosphorus the subsoil is but poorly supplied with plant-food materials.

The presence of quartz in the soil is difficult of explanation and the question arises whether it definitely is this mineral. Whatever it consists of, there is no doubt that much if not all must be in a fine state of division, as the percentage of sand in the soil only amounts to 3.2%. Again, in the deeper layers it is practically non-existent, so that it does not seem probable that there was any large amount of quartz in the parent-rock material. Consequently if it really is this mineral, it must be derived as a product of the decomposition of the original rock. There is no great change in the molecular $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio at the different depths, and if this combined water is recalculated in a quartz free basis, it also is about constant, so that the degree of laterisation does not alter with the depth. This is further borne out by the molecular $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio of the clay fraction.

ANALYSIS OF CANE JUICE AS AN INDICATION OF LACK OF PLANT-FOOD IN THE SOIL.

Twenty samples of White Tanna were taken from fields in various parts of the island, the soils of which had already been examined, to see if there is any correlation between the available P_2O_5 , exchangeable K_2O and exchangeable CaO in the soil and the amounts of these substances present in the juice. Up to the present no distinct correlation has been found; this may be due to the application of factory residues, manure and fertilisers to the canes, so that these do not give a true estimate of the soil. That the fertilisers do have an effect on the juice is shown by the varying P_2O_5 content of the juice from the different series of plots in the St. Aubin S.E. Phosphate trial, and also by the Potash trials at Sans Souci S.E. The potash in the "S," "A," "B" and "C" plots of the latter was 0.137, 0.149, 0.158, and 0.162% ccs. juice respectively, whilst the P_2O_5 and CaO contents remained the same. Consequently it is quite possible that the effect of the fertilisers, etc., has masked the soil effect, so that the findings are inconclusive.

MANURIAL TRIALS.

During the year under review nine manurial trials have been reaped: three for testing the optimum quantity of artificial nitrogenous fertilisers, three for potassic fertilisers, and three for phosphatic fertilisers.

NITROGEN MANURIAL TRIALS.

One of these trials, No. 52, was situated at St. Antoine S.E., and was carried out in the field of first ratoons of the variety D.109. The soil in this locality is characterised by a low degree of laterisation, and it is only slightly acid and fairly rich in exchangeable bases, i.e. a comparatively rich soil,

where water is probably acting as a serious limiting factor. The other two trials, Nos. 36A and 36B were situated in one large field, Gros Roches, at Sans Souci S.E. The soil in this locality is of the most highly-laterised type being yellow in colour, acid in character, and very low in exchangeable bases, due to the intensive leaching which it has undergone, on account of the high rainfall in this part of the island. In this region, therefore, water is not likely to act as a limiting factor, but it is possible that lack of mineral plant foods is limiting crop production. The details of these trials are given in Table VIII and the calculated results in Table IX.

TABLE VIII.

Estates— No. of Trial—	St. Antoine S.E. No. 52	Sans Souci S.E. No. 36A	Sans Souci S.E. No. 36B
Soil Type	... slightly laterised	Yellow soil, highly laterised	Yellow soil, highly laterised
Area of each plot...	0.1 arpent	0.125 arpent	0.125 arpent
Date of plantation	Virgins cut, 8.9.32.	October, 1931.	October, 1931.
Date of cutting	... 16.8.33.	16.8.33.	17.8.33.
Additional fertilisers applied per arpent:			
" A " plots	... 50 kgs. nit. of soda	100 lbs. nit. of soda + 40 lbs. sul. of ammonia	
" B " plots	... 100 kgs. nit. of soda	200 lbs. nit. of soda + 80	do.
" C " plots	... 200 kgs. nit. of soda	400 lbs. nit. of soda + 160	do.

TABLE IX.

Estates—	St. Antoine No. 52	Sans Souci No. 36A	Sans Souci No. 36B
Mean yield of 10 standard plots	18.58 tons per arpent	41.29 tons per arpent	39.87 tons per arpent
Mean difference of:			
3 " A " plots	+ 1.44 $\pm$ 1.15 t.p.a.	+ 2.39 $\pm$ 1.36 t.p.a.	+ 2.56 $\pm$ 0.9 t.p.a.
3 " B " plots	+ 1.67 $\pm$ 1.15 t.p.a.	+ 2.48 $\pm$ 1.36 t.p.a.	- 1.25 $\pm$ 0.9 t.p.a.
3 " C " plots	+ 1.18 $\pm$ 1.15 t.p.a.	- 0.18 $\pm$ 1.36 t.p.a.	+ 1.85 $\pm$ 0.9 t.p.a.

In the case of these trials, samples were taken from all the plots and analysed, but in no case was there found to be a significant difference between the standards and controls as regards the richness or the purity of the juice.

In trial No. 52 a small, though not significant, increase has been obtained with each series of plots, suggesting that small increases may possibly be obtained by the use of artificial nitrogenous fertilisers with first ratoon canes. Rainfall was scarce during the crop season under discussion and therefore would act as a serious limiting factor in this district and consequently the nitrogenous fertilisers may not have shown their maximum effect. Although there is a slight difference between the nitrogen and no-nitrogen plots, there is no such difference between the " A," " B " and " C " series, suggesting that in any case the smallest application would be the most profitable, under the conditions of the experiment.

In trials 36A and 36B, one series of plots in each case gave erratic results, due chiefly to one plot in each series giving a very poor yield. A consideration of the results as a whole, however, leaves little doubt that the application

of nitrogenous fertilisers has resulted in small but fairly significant increases. There is again no evidence that the large applications have given higher yields than the smallest quantity. It may be therefore that the function of the artificial nitrogenous fertilisers is to act as a stimulant to the small canes by causing them to develop vigorous stools, which can then obtain their nitrogen supply from that pre-existing in the soil. If this does prove to be the case in future experiments it would seem that all the nitrogen to be applied to the virgin crop in artificial fertilisers should be given as soon as the plants are able to utilise it.

Since 1930 twelve nitrogen manurial trials have been reaped—eight of these have shown no significant increases in yield; in three, small but significant increases, and in one a small but significant decrease. In those where increases were obtained there was little or no difference between the various applications. With a virgin crop, receiving about 20 tons of normal farmyard manure per acre, about 100 kilogrammes of nitrogen in the organic form is applied. It is probably on this account that artificial nitrogenous fertilisers do not have a more marked effect in the case of virgin canes.

PHOSPHATE MANURIAL TRIALS.

Three phosphate trials have been reaped, all of them continued in first ratoons from the experiments in virgin canes described in the previous Annual Report. The amounts of phosphatic fertilisers applied to the various plots are given in Table X and the calculated results in Table XI.

TABLE X.

Estates—		St. Aubin S.E.	Beau Vallon S.E.	Deep River S.E.
Soil Type	...	Yellow, highly laterised	Yellowish-brown, intermediate	Yellow, highly laterised
Virgins cut	...	3.9.32.	28.11.32.	5.9.32.
1st Ratoons cut	...	3.10.33.	20.11.33.	October, 1933.
Additional fertilisers applied per acre:				
"A" plots	...	100 lbs. guano phosphaté	50 kgs. guano phosphaté	75 kgs. guano phosphaté
"B" plots	...	200 lbs. guano phosphaté	100 kgs. guano phosphaté	150 kgs. guano phosphaté
"C" plots	...	400 lbs. guano phosphaté	200 kgs. guano phosphaté	300 kgs. guano phosphaté

TABLE XI.

Estates—		St. Aubin S.E.	Beau Vallon S.E.	Deep River S.E.
Average yield of 10 "S" plots		35.2 t.p.a.	30.7 t.p.a.	25.0 t.p.a.
Average difference of:				Average yield of
3 "A" plots	+ 6.6 ± 1.36 t.p.a.	+ 0.3 ± 0.95 t.p.a.	3 "A" plots	25.5 t.p.a.
3 "B" plots	+ 9.6 ± 1.36 t.p.a.	+ 1.4 ± 0.95 t.p.a.	3 "B" plots	25.1 t.p.a.
3 "C" plots	+ 11.2 ± 1.36 t.p.a.	+ 0.2 ± 0.95 t.p.a.	3 "C" plots	23.8 t.p.a.

Samples of cane from the various plots were examined, but on account of the difficulty of obtaining a truly representative sample, it is very difficult to state with any degree of confidence whether the phosphatic fertilisers have affected the quality of juices. On the whole, however, there is a tendency for the treated plots to be slightly richer than the control plots.

It will be seen that in the trials situated at Beau Vallon S.E. and at Deep River S.E. no significant results are recorded, whereas at St. Aubin S.E. the results are of a highly significant nature, and that the results in first ratoons bear out those obtained with the virgin crop in each case.

Of by far the greatest interest is the trial conducted at St. Aubin S.E. in which the increases recorded are due to the residual effect of the phosphatic guano applied to the virgin crop plus the effect of that applied to the first ratoons. If the increments in yield are plotted on a graph against the amount applied, it will be seen that in both crops the points lie along smooth curves. By extrapolation it may be deduced that under present conditions the maximum increase which could be obtained by means of phosphatic fertilisers would be in the neighbourhood of 12 tons per acre.

Once again in this trial the juice of the treated plots seems to be definitely richer in P_2O_5 than that from the control plots, the average content for the "S," "A," "B" and "C" plots being 5.8, 7.0, 6.7 and 8.3 milligrs. of P_2O_5 per 100 ccs. of juice. The recovery of the added phosphoric acid in the juice is very low, probably on account of the very high fixing power which these highly-laterised soils possess, as shown earlier in this Report.

POTASH MANURIAL EXPERIMENTS.

Three of these trials were reaped during the year, two being situated at Sans Souci S.E. on a highly-laterised soil type, and the other being situated at Rivière des Anguilles on a yellowish-brown soil of the intermediate type. The various treatments are given in Table XII and the calculated results in Table XIII.

TABLE XII.

Estate—	Sans Souci S.E. No. 37A	Sans Souci S.E. No. 37B	Riv. des Anguilles S.E. No. 51
Soil Type	Yellow, highly laterised	Yellow, highly laterised	Yellowish-brown, intermediate.
Variety	White Tanna	White Tanna	R.A.14/24.
Area of each plot	0.125 arpent	0.125 arpent	0.014 arpent
Date of planting	October, 1931.	October, 1931.	17.8.1932.
Date of cutting	8.8.1933.	10.8.1933.	26.10.1933.
Additional fertilizers applied per arpent:			
"A" plots	80 lbs. sul. of pot.	80 lbs. sul. of pot.	50 kgs. sul. of pot.
"B" plots	160 lbs. sul. of pot.	160 lbs. sul. of pot.	100 kgs. sul. of pot.
"C" plots	320 lbs. sul. of pot.	320 lbs. sul. of pot.	200 kgs. sul. of pot.

TABLE XIII.

CALCULATED RESULTS OF POTASH MANURIAL TRIALS.

Estates—	Sans Souci S.E. No. 37A	Sans Souci S.E. No. 37B	Rivière des Anguilles S.E. No. 51
	Tons of cane per arpent	Tons of cane per arpent	Tons of cane per arpent
Average yield of 10 "S" plots	34.29	37.86	32.1
Average difference of plots:			
3 "A" plots	+ 1.60 ± 1.30	+ 0.85 ± 2.26	- 1.9 ± 1.6
3 "B" plots	+ 2.96 ± 1.30	+ 1.31 ± 2.26	+ 1.0 ± 1.6
3 "C" plots	+ 4.61 ± 1.30	+ 4.08 ± 2.26	- 1.0 ± 1.6

No significant increase in yield has resulted from the application of sulphate of potash in trial No. 51, and this bears out the results obtained from trial No. 29, conducted at the same estate and described in the Third Annual Report of the Sugarcane Research Station. It is not to be expected therefore that the lack of potash is acting as a limiting factor to plant growth on the soils of this estate.

In both the trials 37A and 37B increases have resulted from the application of sulphate of potash, and although they are not significant in the latter on account of a rather high standard error, yet when the two are considered conjointly there is no doubt that the increases are caused by the potassic fertilisers. It would appear that applications of 320 lbs. of sulphate of potash per acre are not sufficient to give the maximum yield, but the point whether heavier applications would be economical or not, requires further investigation.

The soil of the experimental field at Rivière des Anguilles S.E. contains 0.037% exchangeable K_2O , whilst that of trial 37A contains 0.009%, and that of trial 37B contains 0.018% K O. In 1932, a soil at Rich Fund S.E. containing 0.013% exchangeable K_2O responded, whilst one at Rivière des Anguilles S.E. with 0.067% exchangeable K_2O showed no response to potash fertilisers. It appears therefore that the K_2O content below which increased yields may be expected as a result of potassic fertilisation lies somewhere between 0.02 and 0.03% exchangeable K_2O . There are many soils in the Colony, all situated in the districts of high rainfall, with lower contents of exchangeable potash than 0.02%, and consequently it would seem probable that applications of potash may be urgently needed on a fairly large area. Indeed the only soils which have contents constantly higher than the figure above-mentioned are situated in the hotter and drier parts of the Island.

OTHER INVESTIGATIONS.

THE USE OF THE HAND SUGAR REFRACTOMETER.

In the January, 1931, issue of the *International Sugar Journal*, an article on the use of the Refractometer in Cane Seedling Selection Work was published. The cane varieties used in this work were principally noble canes, and it was found that a strong positive correlation ($+ 0.89 \pm 0.02$) existed between the refractometer solids and the sucrose content of the juice.

In view of the fact that many of the seedlings selected contain other than noble blood, it was considered advisable to continue this work to see whether this fact would affect the previous conclusions. The normal practice during the reaping of the Latin Square trials (2nd trial) is to examine every stool by means of the hand refractometer, three readings from each being taken. Since there are 10 stools of each variety, the average for the whole is the mean of 30 readings and so should be very accurate. In 10 of these trials reaped in 1933, one cane was taken from each stool and the composite sample from each variety was crushed and examined in the usual way.

The results from the Pamplemousses Experiment Station were grouped together, as were those from the Central Experiment Station. Very high positive correlations were found, as will be seen below.

Pamplemousses Experiment Station.

Number of varieties	70
Coefficient of correlation between Refractometer Brix and Density Brix	$+ 0.917 \pm 0.007$
Coefficient of correlation between Refractometer Brix and Sucrose % juice	$+ 0.924 \pm 0.006$

Central Experiment Station, Réduit.

Number of varieties ...	...	...	...	...	30
Coefficient of correlation between Refractometer Brix and Density Brix ...	...	...	...	+ 0.854 ± 0.011	
Coefficient of correlation between Refractometer Brix and Sucrose % juice ...	...	...	...	+ 0.949 ± 0.004	

These figures show that the conclusions drawn from the analysis of chiefly noble varieties are equally reliable, even when the varieties under consideration contain blood of different species, including Uba Marot, POJ.2878, POJ.213, and noble varieties.

EXAMINATION OF BLOCKS OF SEEDLINGS OF VARIOUS COMBINATIONS.

In order to obtain information as to the value of certain combinations for crossing work, about 50 seedlings from each of several combinations were examined by the hand refractometer and cut and weighed separately. In all seedlings from thirteen combinations were examined, but up to the present the calculation of only six sets of results has been completed. These results are given in Table XIV.

TABLE XIV.

CALCULATED RESULTS OBTAINED BY ANALYSIS OF REPRESENTATIVE
BLOCKS OF SEEDLINGS FROM VARIOUS COMBINATIONS
IN CROSSING WORK.

Combinations	Refractometer Brix		Weight per stool in kilos		Coef. of correlation between Brix and weight	No. of stools examined
	Mean	Coef. of variability	Mean	Coef. of variability		
POJ.2878 x M.11/16	18.76	11.6 %	10.26	61.0%	+ 0.157 ± 0.079	49
POJ.2878 x DK.74 ...	20.73	7.9 %	6.28	53.0%	+ 0.10 ± 0.085	48
55.P x POJ.2878 ...	20.40	6.4 %	5.63	47.4%	+ 0.249 ± 0.07	48
M.33/19 x M.13/18 ...	18.11	8.5 %	6.52	45.3%	+ 0.112 ± 0.08	50
POJ.2878 x 87.P ...	20.29	5.53%	5.80	40.7%	+ 0.03 ± 0.093	47
POJ.2878 x Uba Marot	17.34	13.3 %	9.87	48.8%	+ 0.057 ± 0.087	50

Unfortunately these seedlings, though planted in two small plots side by side, were not distributed at random throughout the area and consequently these figures do not enable the value of the various combinations to be compared with accuracy. Certain points of great importance to the plant breeder are clearly shown however, of which probably the most important is the lack of definite correlation, either positive or negative, between the weight per stool and sucrose in the juice as determined by the refractometer. Consequently, it can be definitely stated that if only the most vigorous stools are selected, it does not follow that those poorest in sucrose will be chosen. If the combination POJ.2878 x Uba Marot is considered, it is known that POJ.2878 contains wild blood, and it is almost certain that Uba Marot also contains it. With such a combination therefore it might well be thought that the more vigorous seedlings possess the wild characteristics, including poor sucrose, to a high degree, in which case a negative correlation between weight per stool and sucrose % juice might be expected. Such is not the case, however, as the coefficient of correlation is + 0.057 which definitely shows that these two properties vary independently of one another.

Another point worthy of note is that whilst the coefficient of variability of the Refractometer Brix varies around 10%, that of the weight per stool varies around 50%, so that there would seem to be more hope of obtaining a high-yielding variety by selecting vigorous canes rather than by choosing only the very rich ones. Needless to state, the combination of great vegetative vigour and high sucrose content is the ideal, and this is more likely to be realised in a combination giving high mean figures, with high coefficients of variation. Thus if the seedlings examined had been planted in such a manner as to enable the various crosses to be compared, the combination POJ.2878 x M.11/16 would be the one the most likely to yield an outstanding variety. This comparison is the subject of a further investigation at the Central Experiment Station. Fifty seedlings of each of ten crosses have been planted at random throughout an area containing 500 cane holes, so that when these are harvested it will be able to compare the value of the different combinations.

PERIODICAL EXAMINATION OF THE CANE VARIETY UBA MAROT.

A small block of these canes was sampled at intervals from the middle of September to the end of December, with a view to seeing whether at any period it contained sufficient sucrose to make it worth while planting on even a limited scale for crushing. In the middle of September the cane contained nearly 9% sucrose, but in consequence of a fall of one inch of rain on September 23rd and 24th, the percentage subsequently fell to 6.6% at the end of September. From this date to the end of December the amount of sucrose has risen up to a maximum of 12.64% in December. These figures suggest that it is a very late maturing variety, and it would be interesting to see how this variety behaves in the very dry localities when there is a prolonged drought from the end of August to the end of December.

N. CRAIG,
Bio-Chemist, Sugarcane Research Station.

Réduit,
January, 1934.

PART III. RESEARCH BOTANY.

During the year under review the Physiological Botanist was in charge of the Sugarcane Research Station from January 21st, the day of the departure of the Senior Geneticist on leave, to March 23rd, the day of the return of the Bio-Chemist. During this period, yield trials of imported varieties recently released from quarantine were laid out at the Central Experiment Station, and at St. Antoine S.E., together with a trial of seedlings selected from latin squares at the Central Experiment Station. These trials were laid out on the randomized block system. The selection of 1931 seedlings was completed, and the selected seedlings included in new latin square trials. The data for about 12 completed trials were analysed statistically, and seedlings which proved to be significantly superior are now being tested in row trials at Pamplemousses Experiment Station.

The Physiological Botanist was also in charge of the crossing work at the Central Experiment Station during the current year's crossing season. It was thus impossible to start many new physiological experiments, all available time being occupied in maintaining work already initiated.

PROGRESS OF EXPERIMENTS ALREADY INITIATED.

SETT-SOAKING TRIALS.*

Sett-Soaking trials were laid down at Trianon S.E. and at Pamplemousses Experiment Station in October, 1932. The treatments were: setts soaked in (A) saturated solution of lime (1 lb of lime in 50 gallons of water approximately); (B) a saturated solution of lime, containing in addition 1 lb of magnesium sulphate per 50 gallons; (C) a complete nutrient solution (Knop's solution three times the normal strength); and (D) water alone.

The results as far as the germination of the setts is concerned have already been given in the Annual Report for 1932, where it was shown that a very marked increase in the rate of germination, and a significant increase in the percentage finally established, was obtained as a result of soaking the cuttings. The lime, and lime plus magnesium sulphate were more effective than the other treatments in this connection. Irrigation was not applied in either of the two trials, it being considered undesirable to complicate the issue in any way. As a result the canes at the Pamplemousses Experiment Station did not grow very vigorously owing to drought, but it was decided to harvest the trial at the end of the current crop season rather than leave it over for the next harvest. The trial at Trianon S.E. will be harvested in 1934. The results of the trial at P.E.S. were as follows:

Mean yield of 30 control plots	...	...	= 15.66 tons per acre.
Average difference of 7 " A " plots	...	...	= + 6.53 tons per acre.
Average difference of 7 " B " plots	...	...	= + 6.04 tons per acre.
Average difference of 7 " C " plots	...	...	= + 4.54 tons per acre.
Average difference of 7 " D " plots	...	...	= + 4.78 tons per acre.
Standard error of differences	...	...	= $\pm$ 0.80 tons per acre.

* Similar work has been carried on during the last few years in other sugarcane countries; see *Sugar News*, Vol. 10, p. 815, 1929; *Sugar News*, July, 1931, p. 436. Report Comm. i/c Expt. Sta. Haw. S.P. Ass., 1928. Louisiana Pl. & Sug. Manuf., May, 1927.

Samples of cane from each treatment were examined to determine the density, brix, sucrose, and purity of the juice. No significant difference was observed between the treatments as regards these factors: the mean sucrose content per cent. cane was 18.57. The conclusions which can be validly drawn from this trial are as follows :

1. All the treated plots gave significantly better yields than the controls.
2. There is no significant difference between the treatments " A " and " B."
3. There is no significant difference between the treatments " C " and " D."
4. It is almost certain that treatments " A " and " B " on the one hand were significantly better than treatments " C " and " D " on the other.

It appears as if the nutrient solution and water alone had practically the same effect, suggesting that the cells of the cuttings may have been impermeable to the solutes contained in the former. The lime-containing solutions were much more effective in promoting germination and in effecting increased yields. It appears established that considerable advantages follow the soaking of cuttings for a period of 8 to 12 hours before planting in a saturated solution of lime.

EXPERIMENTS ON THE CONTROL OF ARROWING.

The monthly plantings in the control of arrowing experiment have now been completed. Twelve holes of each of the varieties M.33/19, BH.10(12) and DK.74 have been planted every month from October, 1932, to September, 1933. The experiment is designed to see if the time of planting has any effect upon the time and degree of flowering of the canes.

In those experiments to test the effect of heavy applications of fertiliser on the time of arrowing the fertiliser treatments were applied on 10th January, 1933, at the following rates :

1. High lime plots ... 250 lbs. of lime applied before planting
plus a dressing of 2 lbs. K_2SO_4
+ $1\frac{1}{2}$ lbs. superphosphate + 1 lb.
 $NaNO_3$.
2. High phosphate plot ... 20 lbs. superphosphate + 2 lbs. K_2SO_4 ,
+ 1 lb. $NaNO_3$.
3. High nitrate plot ... 10 lbs. $NaNO_3$ + 2 lbs. K_2SO_4 + $1\frac{1}{2}$ lbs.
superphosphate
4. No nitrate plot ... 2 lbs. K_2SO_4 + $1\frac{1}{2}$ lbs. superphosphate,

Each treatment consisted of 36 holes.

The canes in this experiment have grown remarkably well with the exception of the no-nitrate plot where they are yellowish and much smaller than in the other plots. The best growth appears to have been made in the high-lime plot, where the cuttings also germinated sooner.

GROWTH RATE EXPERIMENTS.

The results of the growth rate experiments carried out during the years 1931 and 1932 have been analysed and the results published in Bulletin No. 2 of the Sugarcane Research Station. A new series of growth rate experiments was carried out at Pamplémousses Experiment Station during the year under review, and a new series is in progress at the Central Experiment Station at the time of writing. The data already obtained have given a good indication of the growth rate curve of P.O.J.2878 and White Tanna, and the present series of data were obtained for BH.10(12) to see how this variety compares with the other two varieties. The data have only just come to hand, so that the results of a complete analysis cannot be given here.

GROWTH OF BH.10(12) AT PAMPLEMOUSSES EXPERIMENT STATION.

For following the growth curve of BH.10(12), 100 canes taken at random from a plot of about one-third of an acre were measured weekly, and records of temperature, soil moisture, evaporating power of the air and rainfall were kept. Of these 100 canes, 94 remained alive and healthy throughout the season, the remaining six being discarded because of borer attack.

The measurements could not be commenced until the beginning of March, so that the whole of the 'grand' season is not shown in the data. However, at the beginning of the grand season there was a drought in 1933, and growth was very slow until the beginning of February.

As in previous years the maximum growth rate occurred in early March. The maximum for BH.10(12) compares favourably with the value obtained for White Tanna in 1930-31 and 1931-32, being an increment of 11.5 cms. per week in the length of cane, but falls below the maximum obtained for POJ.2878 for these two seasons.

There is one difference in the curve when compared to the two previous seasons, viz., the very appreciable growth from the middle of June to the middle of August. (See weeks 16-22 in Fig. 1). In the two previous years growth has been very low at this period. This may be due to a higher temperature, but the temperature data have not come to hand in time to be included in this report.

EFFECT OF SOIL MOISTURE ON GROWTH.

As pointed out in Bulletin No. 2 of this station, soil moisture has a different effect upon growth according to the season. The effect of soil moisture was most marked for the grand season and least marked for the period following the grand season, being intermediate in its effect during the period immediately preceding the grand season. In the data here considered no values were available for the period preceding the grand season, but a dot diagram has been composed for the two other periods. It will be seen that here also (Fig. 11), the points fall approximately along two straight lines, the effect of soil moisture being most marked for the grand season period. It will be seen that an increase of 10% in the soil moisture maintained for one week would cause an increased growth rate of 6 cms. per week approximately. This shows BH.10(12) to be intermediate between White Tanna and POJ.2878 in its response to soil moisture during this period, the values for these two varieties being 5 cms. and 7.0 cms. per week approximately. The value for the period following the grand season is approximately 1.7 cms. per week, which shows that BH.10(12) compares very favourably with White Tanna (1.5 cms.) and POJ.2878 (1.0 cms.) in its response to soil moisture during this period.

There is a good correlation between growth and soil moisture over the whole period ($c = + 0.672$), but when the correlation coefficient is worked out for the two periods separately, it is found to be still higher, the values being 0.76 for the part of the grand season for which data were available and 0.73 for the cold season.

EFFECT OF TEMPERATURE ON GROWTH.

The temperature figures were not available at the time of writing and the analysis cannot be included in this report.

EFFECT OF DRYNESS OF THE AIR.

There is a small, but significant negative correlation, between growth and the evaporating power of the air as measured by the atmometer.

GROWTH RATE OF SUGARCANE AT THE CENTRAL EXPERIMENT STATION.

At the Central Experiment Station there are three series of measurements on POJ.2878 (virgins) : (1) Control canes, (2) Irrigated canes, (3) Canes which first appeared on the stools only all the subsequent canes being removed as they were formed. The latter experiment was to determine whether survival of a limited number of canes only in the stools would cause an increased growth rate of these canes. About 100 canes were measured for the first two series and 48 for the third series. The canes were chosen for measurement when the stools were three months old, and these canes only were measured throughout. There was considerable mortality of the canes due to borer attack, and the degree of mortality differed significantly in the three series.

The figures are as follows :—

	<i>Controls</i>	<i>Irrigated</i>	<i>Babas removed</i>
Initial No. included in the experiment ...	100	98	48
No. of these surviving 9 months later ...	59	78	26

It will be seen that the percentage loss is considerably less in the irrigated canes than in the other two series. It appears that this is due not so much to the direct action of the irrigation water applied, but to the more vigorous stools produced as a result, the more vigorous the stool the less the damage caused by borer. By taking a large number of canes for measurement, the standard error of each weekly growth increment and the significance or otherwise of differences between weekly periods or different treatments can be determined. The measurements at the Central Experiment Station have now been in progress for 40 weeks and will be continued until the next harvesting season. It will be realised therefore that only a cursory examination of the data is possible at this stage. The canes which have been given irrigation have grown at a considerable faster rate than the controls. The growth rate curves of canes of the two series are shown in Fig. III.

THE GROWTH OF THE CONTROL CANES.

The material used for the controls had of course been planted and treated in an identical manner with those subsequently irrigated, they were thus under similar conditions for three months before the measurements were commenced. At three months of age, irrigation was applied to the experimental canes, whereas the controls received no irrigation. When the experiment was commenced the mean length of the 100 control canes and the mean of the 98 canes subsequently irrigated were identical, and it will be seen that the growth increment of the two series of canes for the first week was equal at 2.0 cms. After the first week the growth rate of the control canes was always lower than that of the irrigated canes, with the exception of the 12th week (see Fig. III) where the two values were about equal. During this week the soil moisture of the unirrigated plot rose to nearly 40%, showing that during this week when the growth conditions of the two plots happened to be equal (in that soil moisture was high in both plots) the growth increment was also almost identical, which is a striking confirmation of the similarity of the material in the two series. Examination of the two curves shown in Fig. III will show that the period of the year at which growth is slowest has been very materially altered by irrigation. In the case of unirrigated canes, the lowest rate of growth in the period April to December, 1933, occurred at the beginning of November, although the temperature at this time was high. This is due to the very dry conditions prevailing at the time which contributed to cause a lower rate of growth than even the low temperature of the winter months.

In the case of the irrigated canes the lowest growth increment recorded was at the end of August, when the temperature was very low. After this the rising temperature caused a steady increase in the growth rate, so that during the month of December the irrigated canes were growing at 2.5 to 3.0 cms. per week whereas the control canes only grew at about 0.75 cms. per week.

Owing to the very marked effect of soil moisture in limiting the growth of the control canes, the correlation with temperature is poor (correlation coeff. = + 0.32), whereas the correlation with soil moisture is high (correlation coeff. = + 0.582).

The correlation with evaporating power of the air is also high ($c = - 0.577$), probably owing to the relationship between dry soil and high evaporating power of the air. There was no significant correlation between growth and evaporating power of the air in the case of the irrigated canes.

THE GROWTH OF THE IRRIGATED CANES.

The series of measurements for which the canes were irrigated had two main objects in view : (a) to obtain a more comprehensive picture of the effect of irrigation on the growth of the cane ; (b) to keep the soil moisture content above its limiting value, and thus to isolate more completely the effect of temperature upon growth.

It is fully realised that a complete isolation of the temperature effect is very difficult in practice, since all other conditions which might affect growth must be kept above their limiting values. Thus the evaporating power of the air (which is a resultant of several conditions such as air-humidity, wind velocity, sunlight, etc.) affects growth, together with the nature of the soil, availability of nutrients, etc. However, as soil moisture and temperature are the main factors which affect growth under otherwise similar conditions, it was expected that by keeping the soil moisture above its limiting value a better understanding of the effect of temperature would result. This expectation has been fully realised. The correlation between the growth rate and the temperature over the whole period is remarkably close, and is far higher than any figure obtained for unirrigated canes. The value of the coefficient for the whole period is + 0.840, showing that the growth of the irrigated canes has to a large degree been controlled by temperature.

A dot diagram can be constructed between growth rate and temperature for the irrigated canes ; this is shown in Fig. IV.

It will be seen that an increase in the growth rate accompanies an increase in temperature within the limits of temperature met with in practice. The points fall approximately on a curve which may be a straight line or a very flat logarithmic curve, probable the latter. A straight line seems, however, to be a sufficiently close approximation for practical purposes. This confirms the results obtained in Hawaii on the effect of temperature on the yield of cane.* A few points corresponding to the temperature of 16.5 to 17.0°C lie slightly higher than the curve. A probable explanation of this is that they are points for a period when the cane measured is mainly leaf-sheath, and the values of the growth rate approximate more closely to growth of the leaf-sheath than to growth of the stem, so that the true values are probably lower than the values shown in the figure.

By extrapolation the curve is seen to cross the abscissa line at the temperature of about 14.5°C (58°F), showing that if the temperature drops below this figure, growth practically ceases. This again confirms the point more or less arbitrarily taken by Das (60°F) as the temperature below which no growth takes place.

* U.K. Das, in *Haw. Plant. Record*, 1st Quarter, 1935.

The curve obtained here (Fig. IV) shows an increase in the growth rate of approximately 2.7 cms. per week when the temperature is raised from 16°C to 26°C. This is in the case of young canes, it is quite possible that the temperature relationship of older canes might be different. The equation to the straight line curve of closet fit to the observed points is $y = 1.53 + 0.265(t^\circ - 20)$ where y is the growth rate, 1.53 is the amount of growth at 20°C, 0.265 is a constant, and t° is the particular temperature for which the growth rate is required. When $y = 0$, t° comes to 14.3°C. Taking this temperature as the minimum of mean weekly temperature, below which no growth occurs, the amount of growth which might be expected at various temperatures, assuming that the Van't Hoff Law of Chemical Reaction holds, may now be calculated. Taking the temperature coefficient at 2.0, the velocity of reaction at any temperature will be: $1 + \frac{t - 14.3}{10}$. From this the relative weekly increments at various temperatures is obtained, and from these relative values the actual values when the increment for 20° is 1.53 is obtained. These values are plotted to give the Van't Hoff curve shown in Fig. V.

It will be seen that there is a close agreement between the growth curve and the Van't Hoff curve, except in the higher temperature range where growth falls away from the curve. This may be due to internal causes, or it may be caused by soil nutrients or some other factor limiting the growth to some degree in this region. It is possible that an analysis of the temperature effect in terms of day-degrees, (i.e. the accumulated degrees of temperature over a basal number (15°C) below which no growth occurs) might give a still better picture of the effect of temperature upon growth. When the measurements are complete a full analysis using this method will be carried out.

As would be expected there is no relationship between the changes in soil moisture of the irrigated plot and the growth rate since all the values of soil moisture are above their limiting value; this is confirmed by the insignificant value of the correlation coefficient (-0.19). There is also no significant correlation between the growth of the irrigated canes and the evaporating power of the air showing that when the amount of water available to the roots is ample, the dryness of the air does not limit growth to any appreciable degree.

GROWTH OF CANES, WHERE ONLY A LIMITED NUMBER ALLOWED TO SURVIVE.

In the third series where the canes first appearing on the stool were allowed to survive, any subsequent shoots (babas) formed being removed as soon as they appeared above the surface of the soil, the rate of growth has closely followed that of the control canes. It is doubtful whether the slight differences in their growth rate curves are significant apart from a few outstanding weeks, such as weeks 16, 31, and 37 (see Fig. VI).

On the whole the slight differences seems to imply a slightly higher growth rate of the control canes for the first 20 weeks, and an equally slight increase in the rate of growth of the experimental canes for the second 20 weeks. The net result is that the average growth increment for the whole period is practically equal in the two series. However, if the slight differences observed have any meaning, they could be explained as follows:

(1) For the first twenty weeks a slower rate of establishment of the underground system, owing to the removal of babas before they form many roots, might cause a slightly lower rate of growth of the experimental canes.

(2) For the second twenty weeks (which coincided with the dry season) the amount of moisture of the soil would supply the needs of the two or three canes in the experimental stools more adequately than the larger number of canes in the control stools, with a resulting higher growth rate.

The differences observed are however so small as to have little or no practical value.

THE COURSE OF GROWTH EXPERIMENT.

The lay-out of this experiment has been briefly described in the annual report for 1932. Twenty-five complete stools are dug up at monthly intervals: the fresh weight of each stool is determined together with the fresh weight of the leaves, stem, roots, mother cutting, and rhizomes. The number of stems in each stool with their individual lengths and mean diameter is recorded together with the number of leaves borne on them. The total area of every leaf is determined by measuring the length of each leaf and its width at the middle point. It has been previously found that the area of the leaf is given by the equation: $\text{Area} = \text{length} \times \text{breadth} \times \text{constant}$. This constant differs for different varieties owing to the varietal difference in the shape of the leaves. It has been determined for White Tanna in a previous investigation. The magnitude of the work involved may be deduced from the fact that the number of leaves borne on 25 stools reached the high figure of 1,953 in the month of October, and for each of these the length and breadth was determined and the area calculated.

When all these measurements have been taken, a sample of the roots, stems and leaves are dried in an oven at a temperature of 90° to 92°C , and the dry weight and percentage dry matter determined. The dry samples are ground to a fine powder in a mill, and the following analytical determinations carried out: reducing sugars, sucrose, total nitrogen, ammonia nitrogen, nitrate nitrogen, calcium, potassium, and phosphate.

The object of this work is to obtain a complete picture of the course of growth in the sugarcane, including qualitative as well as quantitative changes. It is hoped to determine the relationship between the growth of organs such as roots, stems, and leaves, and the growth of the stool as a whole. Hitherto the main investigations concerning the growth of the cane have been directed towards the stem in particular, since it is in the stem that the sugar is ultimately accumulated. It is only within recent years that attention has been focussed on the underground system, and as far as the writer is aware, little or no work has been done on the growth of the assimilating surface, although the leaves are the organs wherein the sugars are synthesised.

Finally the analytical data will shed light on the accumulation of sugar and mineral substances in the cane, with possible elucidation of problems concerned with the application of fertilisers. It is premature to discuss the results at this stage, ten monthly harvests have been taken to date, and the results of the complete work promise to be extremely interesting.

Some idea of the course of growth of the stools can be obtained from the following tables. The lengths are in centimetres, the areas in square centimetres and the volume in cubic centimetres.

TABLE I.

Harvest No. and date 1933	Total leaf area of 25 stools	Mean leaf area per stool	Mean leaf area per cane	Mean size of leaf	Total No. of leaves on 25 stools	Mean No. of leaves per stool	Mean No. of leaves per cane	Total No. of canes, on 25 stools	Mean No. of canes per stool	Total volume of canes on 25 stools	Mean volume of cane per stool	Mean length of cane per stool	
March	...	20,872	835	409	66.5	314	12.6	6.16	51	2.04	688	27.5	32.6
April	...	93,288	3,732	1,085	147.1	634	25.4	7.37	86	3.44	4,573	183	81.2
May	...	202,580	8,103	1,468	219.4	923	36.9	6.70	138	5.52	11,330	453	155.9
June	...	310,565	12,423	1,635	255.2	1,217	48.5	6.40	190	7.60	18,750	750	219.4
July	...	419,082	16,763	1,986	291.6	1,437	57.5	6.80	211	8.40	28,010	1,120	276.4
August	...	576,845	23,074	2,384	339.1	1,701	68.0	7.00	242	9.68	45,402	1,816	357.4
September	...	666,375	26,655	2,754	352.4	1,891	75.6	7.81	242	9.68	63,875	2,555	418.7
October	...	715,483	28,619	2,817	366.3	1,953	78.1	7.69	254	10.16	72,063	2,907	432.7
November	...	625,810	25,032	3,243	392.8	1,593	63.7	8.25	193	7.72	83,490	3,340	432.7
December	...	593,654	23,346	2,698	362.4	1,638	65.52	7.45	220	8.80	79,159	3,166	434.9

The striking feature in these data is the very appreciable growth made by the stools throughout the cold season. Previous data on the growth rates have indicated that young canes grow at a faster rate in the cold season than old canes, and the data here considered show that young stools grow at a very considerable rate throughout the cold season. The growth is more a development of the whole stool involving the formation of a good root system, and an extensive assimilating surface rather than the formation of millable cane. It is later, when the stool has been fully established, that rapid formation of millable cane occurs. It will be seen also that the growth is appreciably reduced in the dry months of October, November, and December, the assimilating surface diminishing as a result of the drying up of the older leaves.

Assuming 3,200 stools per acre, the total assimilating surface of sugar-cane (variety White Tanna) per acre, in the locality of Réduit at various ages are as follows :

1½ months after germination	... 268 square metres
4 months after germination	... 3,976 square metres
6 months after germination	... 7,424 square metres
8 months after germination	... 9,216 square metres

In popular terms it may be stated that 4 months after germination an acre of this variety has practically an acre of assimilating surface, and at 8 or 9 months after germination it has more than two acres of leaf surface.

The growth in weight of the stool and its constituent parts are given in the following table, all the weights being in grams :

TABLE II.

Month		Fresh wt. of stool	Fresh wt. of stems	Fresh wt. of leaves	Fresh wt. of roots	Dry wt. of stool	Dry wt. of stems	Dry wt. of leaves	Dry wt. of roots
March	...	254	28	26	14	48	4.2	6.3	2.9
April	...	543	152	128	46	72	21.1	31.4	6.2
May	...	1,185	403	287	93	181	64.0	73.5	14.0
June	...	1,912	711	468	152	303	108	114	25.2
July	...	2,865	1,095	664	250	506	175	172	44.2
August	...	4,331	1,667	916	332	786	290	238	65.9
September		5,337	2,241	1,082	397	960	425	283	72.6
October	...	5,992	2,482	1,131	360	1,211	513	316	72.5
November		6,865	3,108	1,053	322	1,567	774	314	75.2
December		6,785	2,808	947	333	1,612	697	288	78.0

It will be seen that the rate of increase in weight of the stools is very high throughout the cold winter months, but in the dry months of November and December the rate is so small that the sampling error becomes very appreciable in comparison with the amount of growth made.

Another interesting feature is the decrease in fresh weight of roots from September to December, that this decrease does not represent actual loss of roots is shown by comparing the dry weight of roots. The weights of dry roots actually increase slightly during these months : it is obviously due to the very dry conditions causing marked loss of water from the roots, and is rather an interesting example of the limitations of using fresh weight as an index of growth. The relationship between the increase in certain characters affords valuable data as to the efficiency of these characters as indicators of growth. Thus, in Fig. VII, the values of total fresh weight of stool, total volume of cane per stool, and total length of cane per stool are plotted against the corresponding months, on an equivalent scale. It will be seen that the total volume of cane per stool is far better correlated with the fresh weight of the stool, than is the total length of cane per stool.

Such curves as are shown in Fig. VII can be plotted for other quantities such as fresh and dry weight of leaves, stems and roots, leaf area, etc. If the quantities are plotted on an equivalent scale as has been done in Fig. VII, the relationship between such quantities can be determined. All the data necessary to construct such curves are given in Tables I and II, so that the curves will not be included here.

Such curves will show that the increase in all these quantities are more or less closely related to each other and to the increase in the total dry weight of the stool. The latter being one of the best indices of growth, it follows that the other characters may also be used as indices of growth. There is no single feature which follows absolutely the trend of the dry weight curve, the deviation taking place in the dry months of October, November, and December, where the dry weight continues to increase markedly, whereas most of the other quantities tend to fall away from the dry-weight curve. Amongst the various features which may be used as indices of growth, two are outstandingly good, viz., fresh weight of the stool, and total volume of cane per stool. These follow the dry-weight curve far more closely than fresh and dry weight of leaves, fresh and dry weight of roots, leaf area, etc. Of these two characters the total volume of cane per stool appears to be at least as good, if not slightly better, as an index of the increase in dry weight of the stool than the fresh weight of the stool.

THE ANALYTICAL RESULTS.

a. SUGARS.

For the determination of reducing sugars and sucrose in the dried material, the alkaline ferricyanide method of Hagedorn and Jensen has been used. It is possible that slight changes in the proportion of reducing sugars to sucrose may occur on drying, but owing to the numerous other data which have to be obtained, it was impracticable to carry out sugar determinations on the fresh material.

The progress of sugar accumulation for successive months are shown in the accompanying table : the results being in terms of 100 grams dry matter.

TABLE III.

Month	LEAVES			STEMS			ROOTS		
	Reducing sugars	Sucrose	Total sugars	Reducing sugars	sucrose	Total sugars	Reducing sugars	sucrose	Total sugars
March	1.30	2.22	3.52	4.99	5.43	10.42	0.68	1.63	2.31
April	1.29	2.37	3.66	5.18	4.00	9.18	1.38	2.02	3.40
May	1.84	1.66	3.50	6.83	4.34	11.17	1.90	3.24	5.14
June	1.55	1.54	3.09	4.90	4.21	9.11	0.90	2.47	3.37
July	1.29	1.44	2.73	8.20	9.82	18.02	0.77	2.85	3.62
Aug.	1.66	2.66	4.32	10.02	9.90	19.92	1.16	3.78	4.94
Sept.	2.57	2.14	4.71	3.97	17.87	21.84	1.18	6.80	7.98
Oct.	1.30	5.16	6.46	5.50	21.32	26.82	1.18	8.06	9.24
Nov.	0.66	3.94	4.60	6.32	20.18	26.50	1.20	9.42	10.62
Dec.	1.90	3.66	5.56	3.78	29.56	33.34	1.36	7.10	8.46

It will be seen that there is a higher concentration of sugars in the leaves and roots with the advent of the dry season, this being caused by an increase in the sucrose content, the reducing sugars remaining constant, but with monthly fluctuations. In the stems the amount of sugar per 100 grams. dry matter is practically constant for the first 4 months or so, but afterwards increases rapidly. In the young stems there is a very appreciable quantity of reducing sugars, which later disappears with accompanying accumulation of sucrose.

b. NITROGENOUS MATERIAL.

For the first four harvests determinations of total nitrogen, nitrate-nitrogen, and ammonia nitrogen were carried out. These determination showed the concentration of the latter forms of nitrogen to be so low however that it was decided to omit these determinations for the later harvests. The concentration of nitrate-nitrogen was about 0.005% of the dry matter, in the case of both leaves stems and roots and the concentration of ammonia nitrogen was of a similar order. The total nitrogen however was comparatively high, and it would be interesting to know in what forms the nitrogen is present. Analysis of cane juice carried out by Browne (*Journ. Amer. Chem. Soc.* Vol. 41, No. 9, 1919) indicate that amino-acids, amides, proteins and nucleins are the forms in which most of the nitrogen is found.

It appears therefore that the sugar cane is neither a nitrate nor an ammonia plant, but is probably best placed in Ruhland and Wetzel's "amide" group. (*Planta* Vol. 3, No. 4, 1927). The results of the total nitrogen content are given in Table IV both in terms of concentration (as a % of the dry matter), and also as the total amount present.

TABLE IV.

Month	Grms N per 100 grs. dry matter			Total amount in grms			Total per stool
	Leaves	Stems	Roots	Leaves	Stems	Roots	
March ...	1.638	1.512	0.888	0.1032	0.0635	0.0254	0.1921
April ...	2.184	1.470	0.812	0.6858	0.3102	0.0505	1.0465
May ...	0.830	0.895	0.510	0.6102	0.5732	0.0714	1.2548
June ...	1.449	1.081	0.598	1.6475	1.1675	0.1507	2.9657
July ...	1.423	1.074	0.607	2.4434	1.8823	0.2684	4.5941
August ...	1.458	0.932	0.560	3.4628	2.7028	0.3690	6.5346
September ...	0.980	0.443	0.534	3.6563	2.6509	0.4849	6.7921
October ...	1.030	0.700	0.355	3.2538	3.5889	0.2574	7.1001
November ...	0.816	0.629	0.454	2.5614	4.8678	0.3415	7.7707
December							

It will be seen that the sugarcane accumulates comparatively large amounts of nitrogen, the whole stool containing about 8 grms. of this substance by November (probably more than this since the whole stool does not include rhizomes, dead leaves, leaf bases, etc.)

c. POTASSIUM.

In Table V are shown the concentrations of potassium (as K) in the various organs, together with the total quantities per stool, at monthly intervals.

TABLE V.

Month	Grs per 100 grs. dry matter			Total amount in grms			Total per stool
	Leaves	Stems	Roots	Leaves	Stems	Roots	
March ...	1.090	1.930	0.501	0.0687	0.0811	0.0143	0.1641
April ...	1.123	1.870	0.992	0.3526	0.3946	0.0617	0.8089
May ...	0.668	1.620	0.708	0.4912	1.0374	0.0991	1.6277
June ...	1.145	1.950	0.390	1.3019	2.1060	0.0918	3.4997
July ...	0.808	1.460	0.594	1.3874	2.5588	0.2627	4.2089
August ...	0.823	1.294	0.512	1.9546	3.7526	0.3374	6.0446
September ...	0.723	1.082	0.377	2.0490	4.6028	0.2737	6.9255
October ...	0.659	0.839	0.376	2.0818	4.3016	0.2720	6.6554
November ...	0.698	0.716	0.254	2.9800	5.4018	0.1910	7.5728
December							

The sugarcane accumulates a very high amount of potassium, the amount present in the stool at 9 months being about 8 grms. (9.6 grs. K_2O). The weight of potassium present in grams is of the same order as that of nitrogen, and the course of accumulation of the two elements follow each other closely as will be seen in Fig. VIII. In the period March to December, accumulation occurred at its fastest rate during the months May to September, being thus to a large degree correlated with the growth of the stool.

d. CALCIUM.

The quantity of calcium (as Ca) accumulated in the stool is of a smaller order than that of potassium, the total amount of calcium being on the average about one-third that of potassium. The highest rate of accumulation of calcium also occurred in the period May to September, the biggest increase being in the period May to June.

In Table VI the data on concentrations and total amount of calcium are given.

TABLE VI.

Month	Grs. Ca per 100 grs dry weight			Total amount in grms			Total per stool
	Leaves	Stems	Roots	Leaves	Stems	Root	
March ...	0.242	0.210	0.315	0.0152	0.0088	0.0090	0.0330
April ...	0.307	0.286	0.223	0.0964	0.0603	0.0139	0.1706
May ...	0.254	0.302	0.205	0.1867	0.1934	0.0287	0.4088
June ...	0.430	0.364	0.200	0.4889	0.3931	0.0504	0.9324
July ...	0.337	0.325	0.191	0.5787	0.5696	0.0840	1.2323
August	0.350	0.240	0.185	0.8313	0.6960	0.1186	1.6459
September	0.277	0.225	0.173	0.7850	0.9572	0.1256	1.8678
October	0.270	0.190	0.218	0.8529	0.9741	0.1581	1.9851
November	0.212	0.177	0.222	0.6655	1.3698	0.1670	2.2033

e. PHOSPHATE.

The quantity of phosphate present in the stool is of the same order as that of calcium, and even in terms of milligram equivalents the curves still follow each other fairly closely, suggesting that the stool may be accumulating phosphate as calcium phosphate. The curve of phosphate-content per month is not quite so regular as that of calcium, the rate of accumulation being low in the period July-August.

Table VII contains the data on phosphate accumulation.

TABLE VII.

Month		Grs P_2O_5 per 100 grs. dry weight			Total amount in grms			Total per stool
		Leaves	Stems	Roots	Leaves	Stems	Roots	
March	...	0.302	0.185	0.192	0.0190	0.0078	0.0055	0.0323
April	...	0.399	0.411	0.270	0.1253	0.0867	0.0168	0.2288
May	...	0.400	0.346	0.176	0.2941	0.2216	0.0246	0.5403
June	...	0.394	0.392	0.148	0.4480	0.4234	0.0373	0.9087
July	...	0.286	0.335	0.098	0.4911	0.5871	0.0433	1.1215
August	...	0.243	0.191	0.069	0.5771	0.5800	0.0455	1.2026
September	...	0.255	0.236	0.063	0.7227	1.0039	0.0487	1.7723
October	...	0.296	0.276	0.154	0.8529	1.3875	0.117	2.3521
November	...	0.223	0.229	0.149	0.7000	1.7722	0.1121	2.5843
December								

It is hoped to proceed with this course of growth experiment, until the canes are ready to harvest in August 1934.

ROOT INVESTIGATIONS.

It has not been possible to follow the complete scheme of root investigations which had been planned, owing to the writer being engaged on crossing work at that time of the year which is most suitable for root work, (i.e. the cooler months). However, the development of the root-system from the sett has been followed, the formation of the root system of ratoon crops has been studied in some detail, and the root system of a promising cross POJ.2878 and Uba Marot was studied by the block method, and reconstructed at Pamplémousses Experiment Station, where it was exhibited on the occasion of "Planters Day."

THE ROOT SYSTEM OF A RATOON CROP.

When the ratoon crop commences its growth after the removal of the previous crop, it is furnished with a very extensive root-system. This root-system undoubtedly surpasses the needs of the stool at this stage, but becomes of great importance a few months later when the dry period sets in. It is probably owing to this well-established root-system that young ratoons generally look so healthy and green as compared to young virgins at the same time of the year.

The roots of the ratoon crop remain active for a considerable period after the previous crop is harvested : the roots explore the interline very closely, and have a matrix of absorbing rootlets which bear actively absorbing root hairs for three months or more after the previous crop is removed. This system is characterised by being very superficial, being mostly contained in the first six inches or so of soil. It might be expected that the bursting of the stool into renewed activity would cause new absorbing rootlets to be formed on the main system already in existence. Although this occurs to a limited extent, it is not the means by which the root system of the ratoon crop is developed. The root system inherited from the previous crop gradually ceases to function, and the rootlets decay ; a completely new absorbing system being formed by

the ratoon stool. The latter only uses the root system already in existence to tide over the period from the removal of the crop, until its own "babas" have formed shoot-roots which once again explore the interline, branching profusely, and giving rise to the new root-system of the ratoon crop. The ultimate formation of the new root system thus takes place in a similar manner to that of a virgin crop.

Tilling of the interline to a depth of 6 to 8 inches soon after the removal of the previous crop had no marked effect on the course of development described above, although it appeared to increase to some extent, the number of new rootlets borne on the previously existing root-system. However, as this root-system was probably more than adequate for the stool in its degree of development at the time, it has little effect on the growth at this stage. It is much later, when the new root system formed from the growing babas is developing that the effect of tilling becomes more marked. The increased aeration and drainage of the interline which results from the tilling operation appears to cause a more vigorous development of the new root system.

ROOT BOX STUDIES.

In the root box studies a stool was grown in a specially made box with one side composed of glass graduated in square centimetres, and placed at an angle of 30° to the vertical. The glass-side was covered by a removable wooden side, so that the roots were in darkness except for the period during which they were examined. The position of each root which appeared against the glass was recorded daily to scale on graph paper. The variety used was White Tanna Mon Désert which was planted towards the end of December, 1932. Roots were first observed against the glass (i.e. about 1'6" from the centre of the stool) about one month after planting, and very vigorous root growth continued until the end of February, when the root growth slowed down. It may be that after 3 months or so the box was becoming inadequate for the normal growth of the stool, so that in future, experiments of this nature are to be carried out in the field, where the glass-side is placed against the side of a trench dug for the purpose.

In this experiment although the roots in the surface soil bore the greatest profusion of root-hairs, the roots in the subsoil were also densely covered. The probable reason for this is the looser texture of the subsoil in an experiment of this nature than occurs in the field, suggesting that aerating the subsoil and breaking it up would cause a markedly better root development. The white roots which appear against the glass grow very vigorously for a time, an increment of as much as 8 cms in twenty four hours having been observed. Many of the roots undergo interesting changes as they mature. They are initially white in colour, but after a week or so they develop a pink pigment in the older parts, the pink colouration gradually progressing along the root towards the tip. Further changes later take place, in which the pink deepens to purple, and passes through shades of brown until the roots are eventually quite black. No branching, apart from that giving rise to minute rootlets, could be observed in young roots, branching taking place after the root had matured as shown by its brown colouration. Artificially pruning the roots in the early stages did not seem to cause more vigorous branches.

Further experiments of this nature are now being carried out.

THE ROOT SYSTEM OF A SEEDLING OF THE CROSS POJ. 2878 x UBA MAROT.

The stool investigated consisted of a very vigorous seedling from the above cross. It was 18 months old (i.e. a fully matured virgin stool) and bore 35 canes. It was excavated, by the block method, the position of each

root being drawn to scale on graph paper, and the inner and outer depth of each root recorded. When the excavation was complete the stool was taken down to Pamplemousses Experiment Station where it was reconstructed in a frame measuring 8 ft x 8 ft x 6 ft and later exhibited and photographed.

NATURE OF THE ROOT SYSTEM.

This root system was the most extensive one yet found. The surface spread was not as great as in noble canes, and branching of the roots in the surface soil was not profuse. Assuming the system in the first foot of soil to represent the major part of the absorbing system the latter cannot be described as being as highly specialised as in some of the noble canes investigated. Even so it must have been highly efficient, since the top growth was so vigorous.

The most marked character of this root system was its deeply seated nature, roots in the second foot of soil were nearly as numerous as those in the first foot. Down to a depth of 2-3 ft, the roots passed outwards more or less horizontally from the stool. This contrasts with noble cane varieties which usually have roots passing outward horizontally only in the first 9" to 1 ft of soil, the roots below this depth passing downwards at an angle of 45° to 60° from the horizontal. Whereas the root system of the noble canes hitherto examined seldom passed down to greater depths than four to five feet, this stool had very numerous roots to this depth, and anchoring roots passed down vertically to far greater depths. These anchoring roots provided the best examples yet seen of the rope-like groups in which many roots become associated, and well bound together by their own rootlets as described in the last annual report. These anchoring roots were followed down to a depth of 12 feet, and many were still continuing downwards below this depth. Owing to the tremendous number and extent of the roots from the surface soil down to these depths, the magnitude of this root system easily surpasses that of every stool which has previously been investigated.

It appears to be the type of root system which would best withstand the ravages of both cyclone and *Phytlus*.

Plantings of stools of eight of the most important commercial varieties grown in Mauritius have been made, and it is hoped to make a thorough root study of these by the block method in 1934.

STUDIES OF THE VARIABILITY OF SUGARCANE IN THE FIELD.

The need of data on the variability of sugarcane in the field has been felt for some considerable time. The opportunity for a preliminary study of this nature came in the course of the harvesting season. Over 1,200 stools were individually weighed from a plot of R.P.6 kindly placed at our disposal by the Manager of Trianon S. E.

From this data, the coefficient of variability has been calculated and also the standard error of various sizes and shapes of plot for small scale trials. The coefficient of variability of the population was 48.5 (S. E. 0.6). In comparison with many other crops the variability of sugarcane is thus rather high. A figure of about 50% has been calculated by us for other smaller populations from time to time. From the standard error of the plots the number of replications of plots and treatments necessary to obtain a certain percentage accuracy of the whole experiment have been calculated*. The data here considered are in course of preparation for publication, and will be published shortly as a bulletin.

* See also '*Experimental error of field trials under Mauritius conditions*' by M. Koenig Dept. of Agric. Bull. No. 7 Scientific series.

A PRELIMINARY EXPERIMENT TO TEST THE DIFFERENTIAL RESISTANCE OF SEEDLINGS TO PHYTALUS SMITHI, ARROW.

The object of this experiment was to determine whether there was a varietal resistance to *Phytalus*, and if so, whether this could be demonstrated by means of a simple type of experiment which could be used practically in the case of selected seedlings.

In February, five cuttings of each of the commercial varieties R.P.8, DK.74, BH.10(12), POJ.2878 and White Tanna were planted in 25 half barrels filled with soil. Subsoil was placed at the bottom of the barrels, and baked surface soil to a depth of 8 inches.

Owing to the fact that the aim of the experiment was to demonstrate the differential resistance of the varieties only, no controls were used, but the results turned out to be so clearcut that controls would possibly have made the experiment more quantitative. However the behaviour of the 25 stools had been observed weekly for 14 weeks before the treatment was applied, and without exception they had made good and uniform growth. At the end of April each barrel was infected with *phytalus* larvae, the larvae being applied as follows. Over two hundred larvae were collected every day, and a random sample of 8 larvae applied to each barrel. This was continued for 9 days until there were 72 larvae applied to each barrel. The larvae varied in size, but on the whole were half to three-quarters fully grown. The method of application resulted in the dosage being equal for each barrel since they were applied at random. The dosage applied would represent very heavy infection under natural conditions. Very soon afterwards the effect of the *phytalus* began to be apparent in some of the varieties, the leaves assuming a yellowish hue, accompanied by slight wilting. In the variety White Tanna where the effect was greatest, the five stools quickly turned yellow, and marked wilting occurred, the five stools being practically dead three weeks after the infection. In some of the other varieties, such as DK.74 and POJ.2878, the yellowing and slight wilting occurred but the stools did not die.

After six weeks, the barrels were emptied, and the number of live larvae in each carefully collected and counted. The larvae appeared to be fully grown at the conclusion of the experiment. The mean number of live larvae found in each variety was as follows : R.P.8 = 48.4 ± 3.0 ; DK.74 = 54.2 ± 2.5 ; BH.10(12) = 53.8 ± 2.5 ; POJ.2878 = 53.8 ± 2.3 ; White Tanna = 48.2 ± 3.4 There is no significant difference between the number of larvae surviving in the five varieties.

The weight of the roots of each stool at the end of the experiment was also determined. The mean weights per stool for the five stools of each variety are as follows :

BH.10(12) = 149.9 grs ; R.P.8 = 119.1 grs ; DK.74 = 90.5 grs ; POJ.2878 = 33.0 grs ; White Tanna = 26.0 grs.

As a result of the observations of the stools every day from the time the larvae were applied to the end of the experiment, it proved a comparatively easy matter to place the varieties used in order of their resistance. The order is :

R.P.8	} most resistant.
BH.10(12)	
DK.74	} less resistant.
POJ.2878	
White Tanna...	least resistant.

This order corresponded to a high degree with the quantity of roots remaining at the end of the experiment.

This order of course refers to the behaviour of young canes, three months old : it may be that with older stools the order may be different. Again the susceptibility of canes like P.O.J. 2878 to attack when they are young may be due to its slow initial development, and poor root growth in the early stages. This could be corrected by judiciously choosing the time of planting.

There is not much doubt that the experiment has shown that in young virgin stools there is a marked varietal difference in their resistance to phytales attack ; thus indicating the possibility of determining the degree of resistance of selected seedlings.

It appears probable also that the resistance of the mature stools will be determined by the nature of the root system, and the investigation of root-systems by the block method should shed important light on this question.

A further experiment to test phytales resistance of canes is now being laid down in conjunction with the new Phytales Investigation Officer.

Réduit,
January, 1934.

H. EVANS,
Physiological Botanist, Sugarcane Research Station.



*Growth Increment Curve of BH. 10 (12)
at P.E.S., 1933*

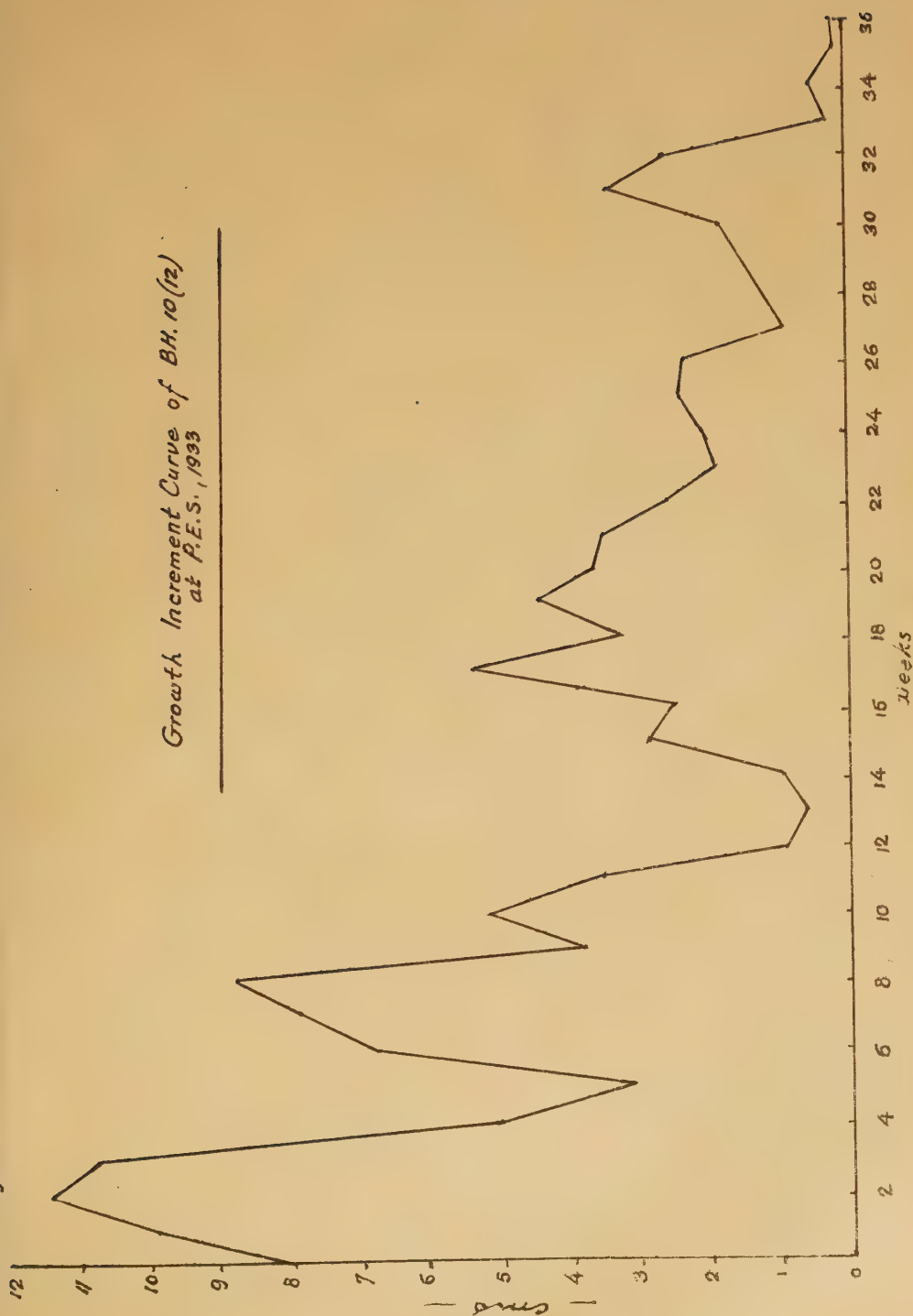
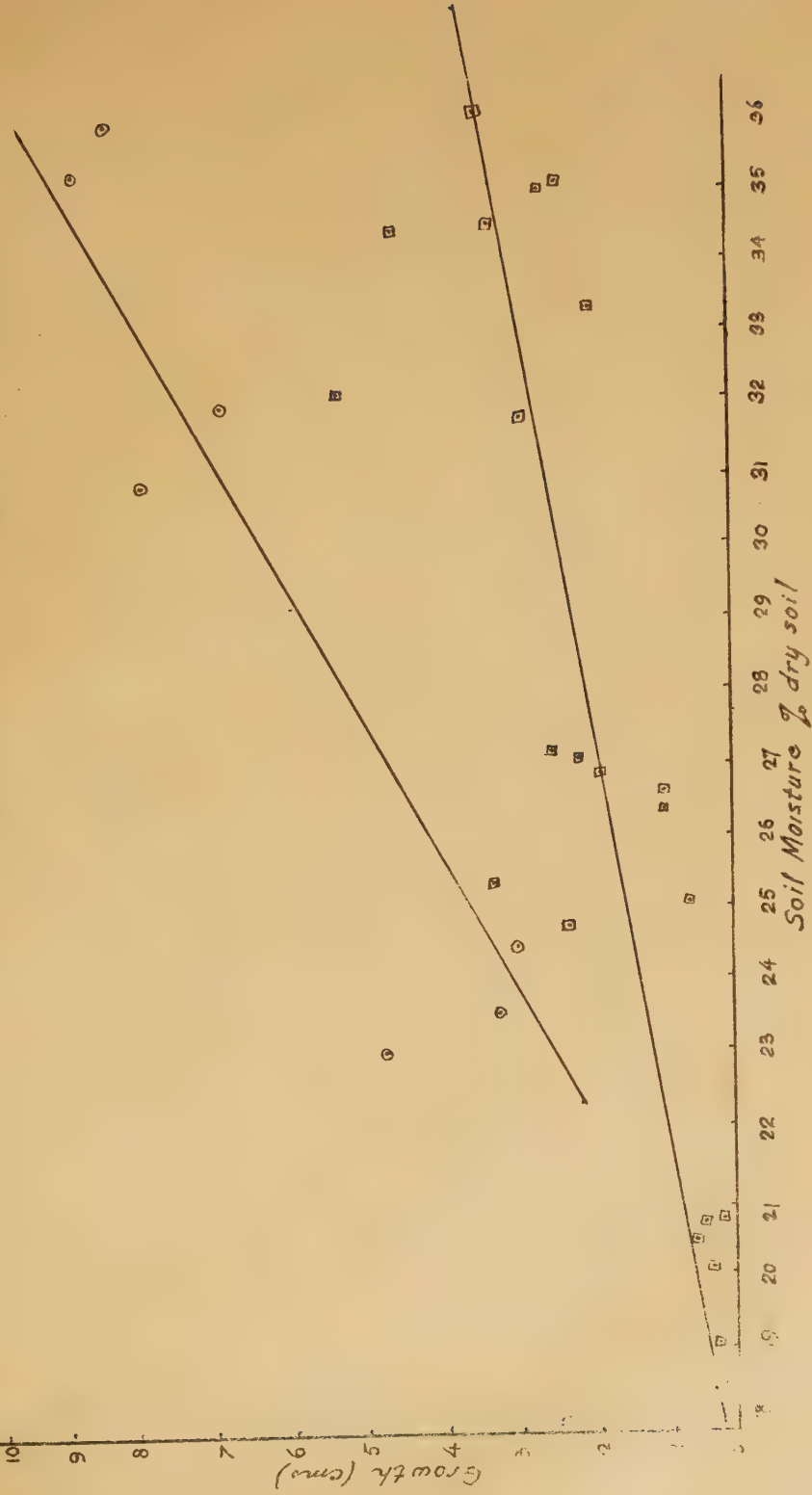




Fig. 2

Dot diagram of Soil Moisture and Growth

○ ... Points for Grand Season
 □ ... " " Period following Grand Season



Growth Increment Curves. POJ 2878 (Virgins)

Fig. 3

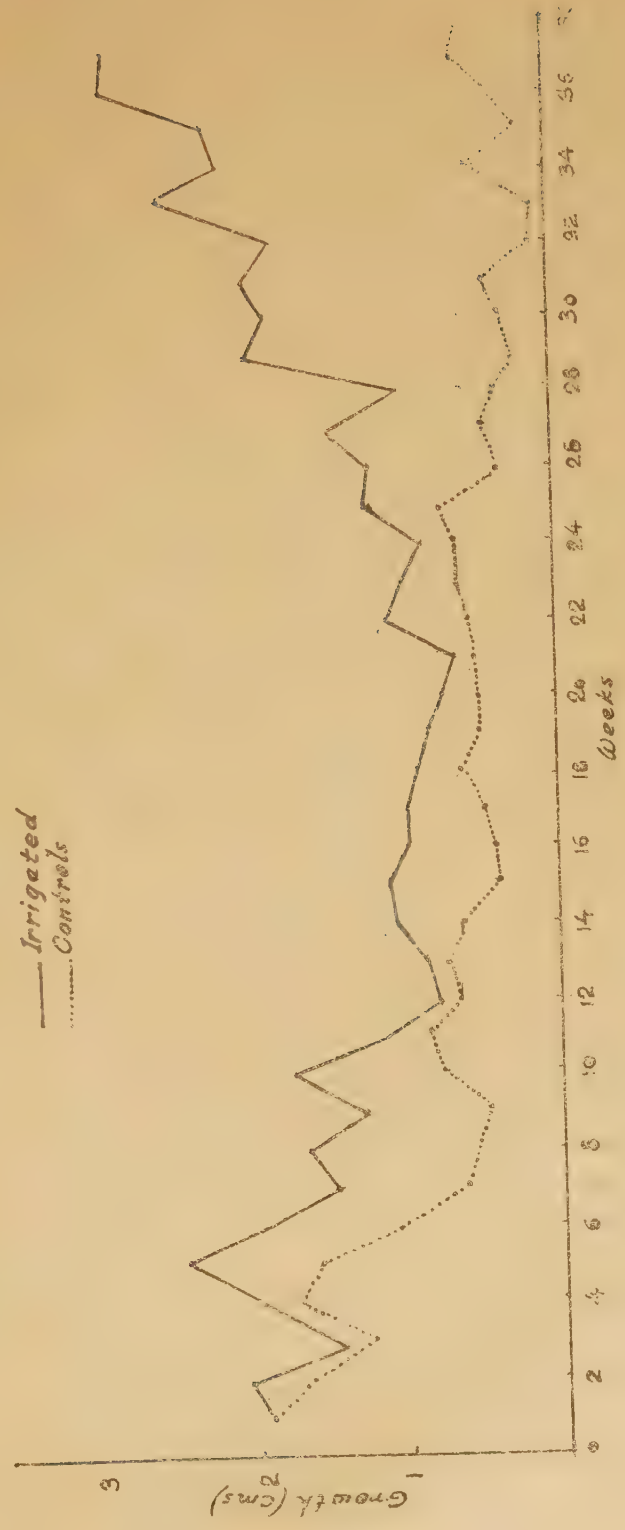


Fig. 4

Dot diagram of Temperature and Growth Curve
(with Soil Moisture above its limitive value)

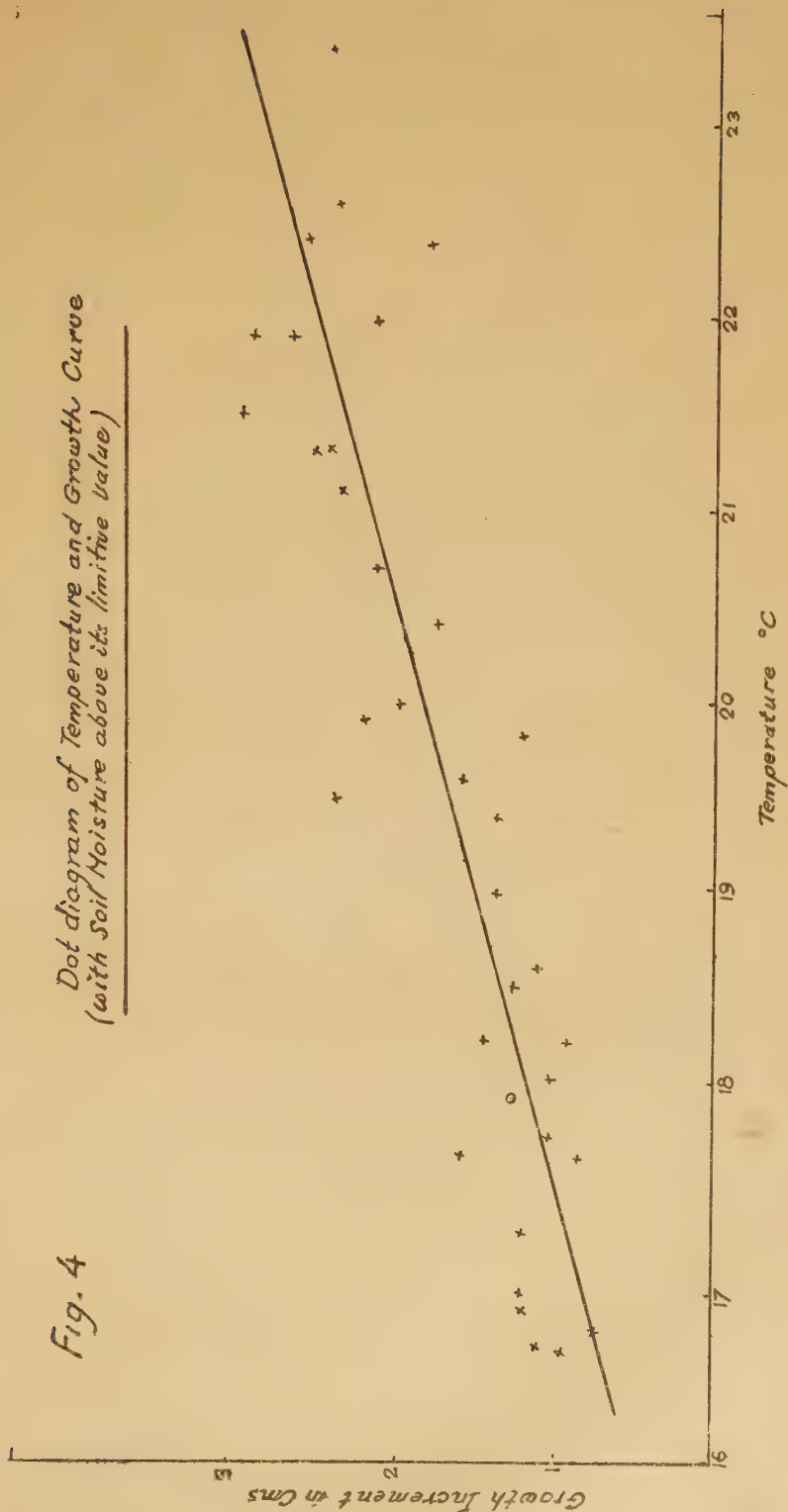


Fig. 5

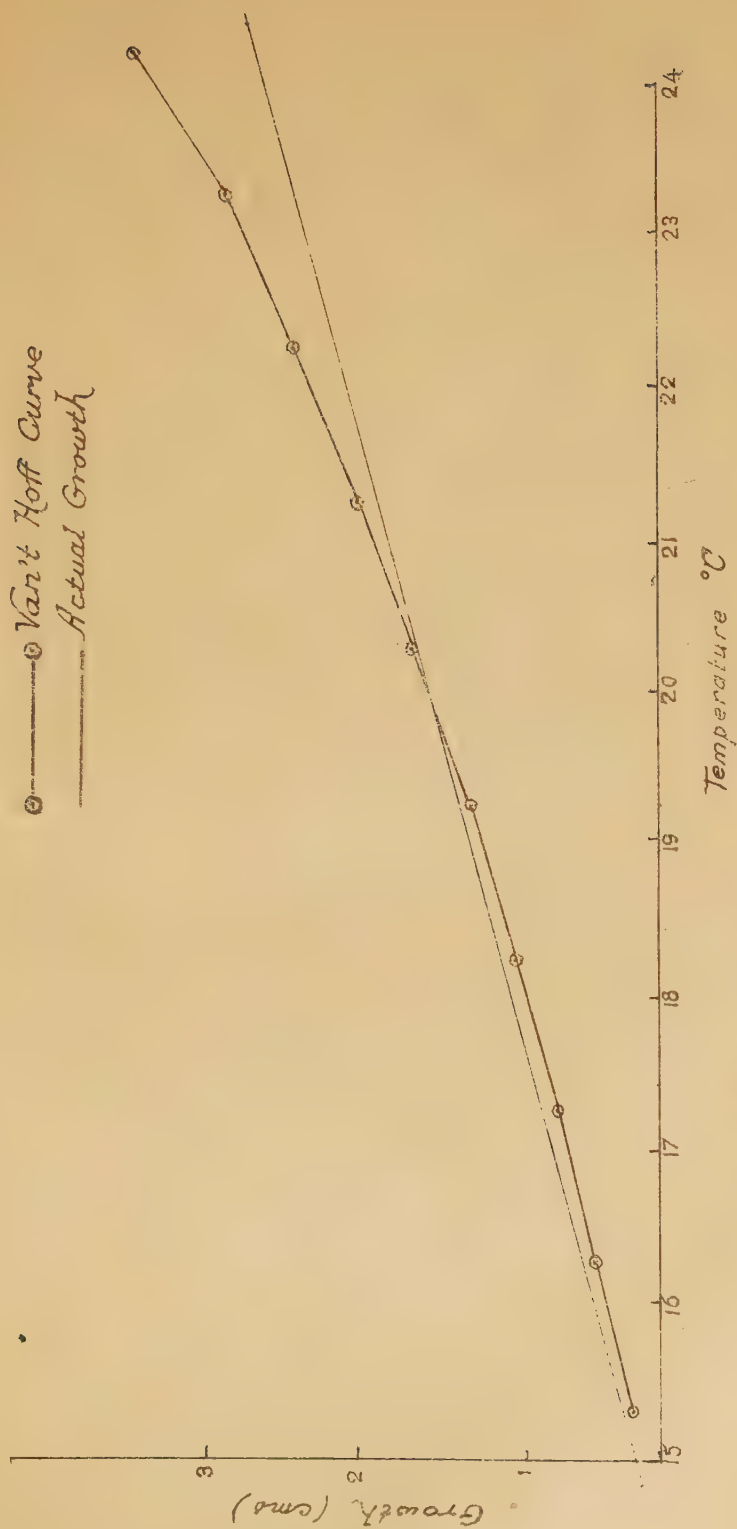


Fig. - 5

Growth Increment Curves of P.O.I. 2878 (Virgin)

Controls

Series 3... Babas removed

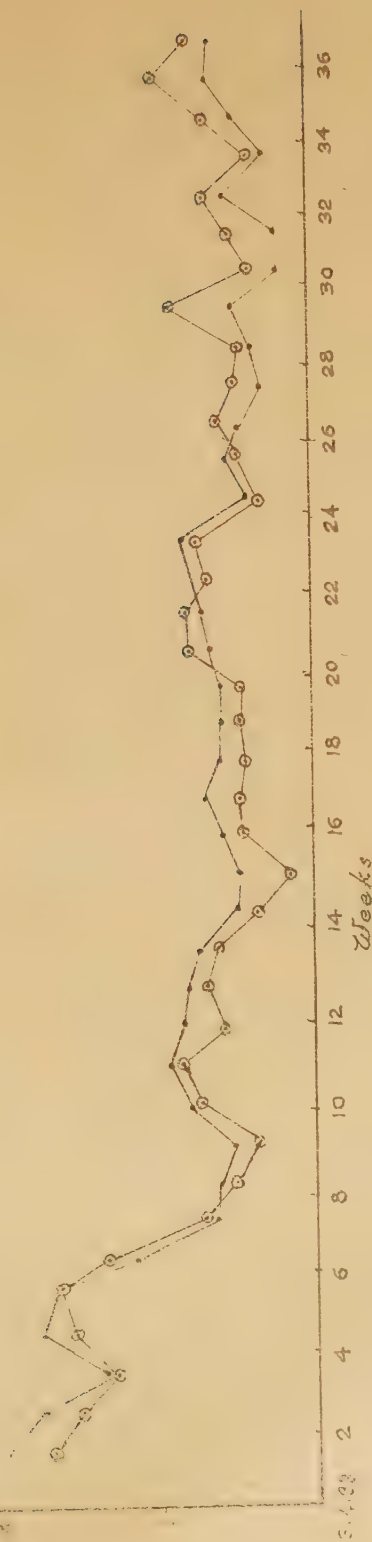


Fig-7

